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A RECONNAISSANCE SURVEY OF PUMICE SOILS.*

ROTORUA COUNTY.

(Continued.)

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IV. SOIL-TYPE BOUNDARIES MAPPED.

THE soil survey of Rotorua County has now reached a stage where it is possible to show on the northern half of the county map the several types of soil which occur and, roughly, to map the boundaries of the types.

The work has been of a most arduous nature owing to the comparative lack of settlement and therefore of means of access, a large part of the area being still under native vegetation. Further, a part of the area is heath country of no agricultural value, in which thermal activity is preventing the growth of anything in the nature of forest, as only the most xerophytic (capable of resisting abnormal soil conditions) plants can exist. A topographical survey is at present being carried out by the Lands and Survey Department, and when the results of this are available it will be possible to prepare a soil map in very much greater detail. At present one must be content with working with a county map on the scale of one mile to the inch.

Pumice soils—by which is meant soils chiefly and obviously consisting of pumice—vary greatly in their quality, which is governed by their texture. This ranges from those soils and subsoils which are so coarse that they must permanently remain as desert, heath, or forest land, to those which are so fine or so compacted that they may be profitably utilized in the grazing of sheep and cattle. Probably all the difficulties in settling coarse pumice lands will be traced to the deficient water content of the soil in spite of the 60 in. to 70 in. of rain which falls annually. Pumice is a word which is supposed by etymologists to be related or derived from the same root which gives spume (spuma-foam). Pumice is, indeed, a solidified foam or volcanic froth and highly absorbent. One finds pumice in all stages of decay, of comminution, and of compaction. It had probably been well leached

* For previous articles of this series see *Journal* for November and December, 1924, and January, 1925.

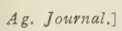
before being redistributed to positions in which it is now found. The final stage of decay or chemical change as pumice is where the fine lumps have become so acted upon by natural agencies that the resultant mass is quite plastic with very little feeling of grittiness. The final stage of comminution is when the pumice is reduced to a fine sand or silt. The final stage of compaction is found in river-terraces in which the weathered and powdered material is laid down into a wonderfully fertile alluvial soil. Soils of all these grades may be found, and some may be termed improved pumice lands, where improvement has gone on to such an extent that farming may profitably be carried on without resorting to exceptional methods.

These studies are for the present limited to the soils derived from the "Rotorua Pumice Shower" and other more recent eruptions in Rotorua County. There are many areas of pumice lands derived from other outbursts possibly of different age, origin, and composition, which may therefore not be comparable with that of the Rotorua Shower. These must be studied separately in their turn. A warning should be given against the practice of speaking of all pumice soils as a class without limitation or definition. To make general statements disparaging to pumice soils is to court disproof by hundreds of successful farmers on what may justly be called pumice lands. It is, on the other hand, dangerous to extol pumice lands indiscriminately as fields for settlement, for instances may readily be given of large areas which are not suitable for settlement by the methods in common use. Seeing that there is this great diversity of soils under the term "pumice," it will be conceded that some scheme of classification must preclude an intensive study of the subject, and the initial step in this direction is exactly what a soil survey of the Rotorua County hopes, among other things, to accomplish.

For a discussion on soil surveys the article in this *Journal* for September, 1923, "The Ideals of a Soil Survey," should be consulted. One may here merely recapitulate that the largest unit used in classifying soils in the United States of America is the "soil province," of which there are some fourteen in that country. A soil province may owe its individuality either to geographical position or to geological origin. A minor unit of subdivision is the "soil series," embracing soils of a common origin which differ only in texture (finess). The smallest unit is the "soil type," which distinguishes between soils of the same series. It is proposed tentatively to regard all soils consisting obviously mostly of air-borne materials derived from the North Island Volcanic Plateau as a soil province. This is a province for the greater part based on geological origin.

The enormous extent of country overlain by the pumice from this area is the subject of remark by all geologists who have traversed the country. Hill ("Pumice, Its Geological Distribution on the East Coast of North Island of New Zealand," *Trans. N.Z. Inst.*, p. 293, vol. 20, 1887) shows that pumice-beds extend from Cape Turnagain in the south to Tolaga Bay in the north, and that pumice covers the Ruahine, Kaimanawa, and Te Whiti Ranges. An area of 5,000 square miles has been affected directly or indirectly by ejectamenta from the Central Plateau. Hill, indeed, in his paper read before the Hawke's Bay Philosophical Institute, says: "I have often thought that a good deal might be said in support of the claims of pumice as being the origin

The black dots show the sites whence soil



NTY SHOWING DIFFERENT TYPES OF SOIL.

amples have been drawn in this survey.



in this district at least of most of the fertile soils." He publishes a sketch-map showing the distribution of pumice of three different ages.

Jameson (*N.Z. Journal of Science and Technology*, vol. 2, p. 209, 1919, "Technical Analysis of Auckland Clays") states that it is probable that the material of the clays under consideration was brought down by the Waikato River, and is the product of decomposition of the rhyolitic pumice occurring in the upper portions of the Waikato Basin. He points out that the formation of clays from rhyolitic glass has not yet been recognized in literature. He gives an instance of the alteration of the rhyolite on Rainbow Mountain, Waiotapu, by local solfataric action into white plastic clay having the composition of pure kaolin. The present writer has noticed lumps of what were obviously once pumice in a cutting near Otanewainuku, which had completely lost their pumiceous character and on gentle pressure were reduced to a plastic mass.

McKay (1899, "Report on the Pumice-stone Deposits of the Middle Part of the North Island: Geological Explorations," pp. 16-25, parliamentary paper C.-9) published a comprehensive paper on the distribution of pumice. He concludes: "Whatever its source, the quantity of pumice distributed over the middle part of the North Island, from Ruapehu to the shores of the Bay of Plenty and the upper end of the Hauraki Gulf, in the middle and lower Waikato and east and west from the sources of the Waipa to the east coast and Hawke's Bay, is enormous, and may well excite curiosity and prompt speculation as to the origin of the same." One can only surmise that if the pumice has influenced the formation of soil as far north as Auckland City, as far east as Tolaga Bay, and as far south as Cape Turnagain, it must be much more responsible for the origin of the fertile lands nearer the source of eruption, and may well be the greatest single soil-former in the North Island, and, as such, worthy of all serious study.

The present writer can confirm what he has quoted from actual experience in his explorations of the Ruahine, Kaimanawa, and Kaweka Mountains. These have been covered in many parts with a deposit of pumice of varying thickness. The pumice has been washed off the mountains and has filled the gullies in many cases, and the rivers have again eroded their beds through the pumice, leaving high terraces of pumice boulders, gravel, sand, and silt. A systematic search of the literature would doubtless show many other instances of the widely spread area affected by pumice, which has evidently influenced a very great area of the North Island land apart from the portion known as the Volcanic Plateau. The present writer is confident that the ultimate future of pumice lands which are now growing or have recently grown forest is exceedingly hopeful, but an intensive study of the areas which have grown nothing better than scrub—manuka (*Leptospermum scoparium*), kanuka (*L. ericoides*), or monoao (*Dracophyllum subulatum*)—is required before anything can be said of the agricultural possibilities of such soils.

A very distinct series of soils is easily identified in Rotorua County as that derived from the Rotorua Shower (Thomas, 1888, "Report on the Eruption of Tarawera and Rotomahana, N.Z.," p. 19). This series (A) owes its individuality entirely to geological origin and

consists of rhyolitic pumice. The types so far recognized and mapped of this series, arranged in the order of their relative coarseness, are,—

- (1.) Fine gravelly and coarse sands, Rotorua lakeside.
- (2.) Fine gravelly sands, Kaharoa (thirty-six square miles).
- (3.) Intermediate between (2) and (4).
- (4.) Coarse sandy silts, Te Pu.
- (5.) Sandy silts, Rotorua and Mamaku (one hundred and thirteen square miles).
- (6.) Sandy loam, Oturoa (twelve square miles).

In Series B there is a very large extent of country of a very uniform composition, consisting mostly of coarse sands and some sandy silts, but containing a proportion of basic material consisting of black scoria (andesite). This is probably material derived from an earlier source than the Tarawera eruption of 1886. These soils lie to the north and north-east of Lake Rotorua and extend out towards the Bay of Plenty.

Series C contains two types—(1) a sandy loam, (2) fine sandy loam. These are derived from the 1886 Tarawera eruption and lie to the east of Lake Rotorua. They are the most fertile and healthy lands in the district, and are remarkable compared with other soils of this district in containing a large proportion of lime soluble in hydrochloric acid; but, as the soil does not effervesce, the lime is therefore not in the form of carbonate but silicate. It will be noticed that generally the finer the texture, as shown by the analysis and volume weight, the healthier the country.

DETAILED CHARACTERS OF THE SOIL TYPES (SEE TABLES).

Series A.

Type 1: These soils are the healthy* lakeside soils which are often submerged and normally are only a few inches above stagnant water. Such a soil is often abandoned to self-sown grasses and clovers, and grows a rank pasture of sedge (*Carex*), Yorkshire fog, and other grasses not favourably recognized as possessing high value on the farm. Stock nevertheless thrive greatly on these lake-flats. The soils are often extremely coarse in texture, but the bad results of this are mitigated by the high water-supply.

Type 2: These are fine gravelly sands of the Kaharoa and Te Pu districts. They are the worst and most unhealthy of any soils met with in the survey. Coarse in texture, they are very often spread over high ridges, and the difficulty of watering stock has to be met by the erection of concrete tanks—often extremely inadequate. Kapakapa Road traverses a typical area of the worst type, but towards the road's end the soil improves, inasmuch as the percentage of pumice decreases and the percentage of denser ejected material increases. The natural vegetation of this area is forest similar to that of the Mamaku sandy silts (Type 5)—tawa-rimu forest, modified, however, by the inclusion of trees requiring milder climatic conditions, such as mangeao (*Litsaea calicaris*) and kohekohe (*Dysoxylum spectabile*). The weight of a cubic foot of moist soil taken under conditions comparable with the other types is 68.75 lb.

Type 3: This is a strip of intermediate material, possibly a mixture of Types 2 and 4.

* "Healthy" means land free from bush sickness; "unhealthy," the reverse.

Type 4: Coarse sandy silts of Te Pu. Is probably a small area of intermediate country with similar flora to Type 2.

Type 5: These are the sandy silts of Rotorua and the Patetere Plateau round about Mamaku. They are the largest of all in extent in this area here dealt with. This type has two distinct plant-coverings. On the highest lands, 1,760 ft. above sea-level, on the plateau the growth is forest of the tawa-rimu type, which is unhealthy country; but as one descends the plateau to the crateriform depression in which the Town of Rotorua is situated, tutu (*Coriaria*) and fern (*Pteridium*) become the native covering. This land can easily be made healthy by treatment. There is no physical difference in the soil. The lower altitude of the Rotorua lake-terraces and possibly proximity to a large body of water give that area a more genial climate, and the natural covering of fern makes the task of breaking in the country much easier.

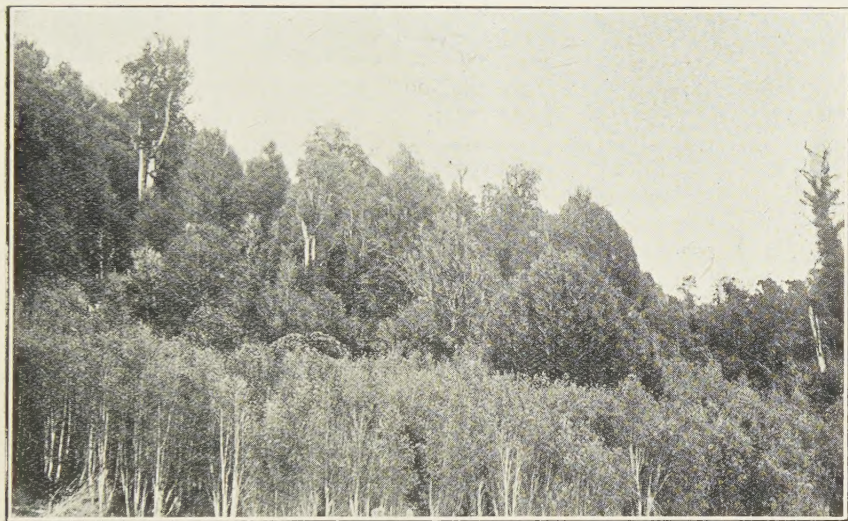


FIG. II. TYPICAL RIMU-TAWA FOREST, PATETERE PLATEAU.

Wineberry second growth in foreground.

In the fern land are no stumps for the rotting of which the farmer has to wait twenty years before he can get the plough in; consequently he starts with the advantages given by ploughing, fertilizing, and cropping the soil. After a burn on forest country it is extremely arduous and costly work extracting the stumps even after twenty years. Weight of cubic foot of moist soil, 75.47 lb.

Type 6: The origin of the sandy loam area of Oturoa is somewhat of a mystery. Situated in the midst of air-borne sandy silts bearing the typical tawa-rimu forest of the kind most resistant to climatic severity, one comes across an area of much heavier soil, carrying a forest which consists largely of two species of beech (called "birch" by the settler)—red-beech (*Nothofagus fusca*) and silver-beech (*N. Menziesii*). There is every reason to think that this area would produce a pasture, and from it stock which would not suffer from iron-hunger (bush sickness). It will be seen that the physical composition of this area

TABLE 7. MECHANICAL ANALYSES.
(Results are percentages on air-dried soil.)

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.	Remarks.			
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.			Moisture.	Loss on Ignition.	
S 490	Fine gravelly sand	..	22.6	55.8	9.3	3.8	2.1	1.1	0.6	5.0	35.4	Lakeside paddocks, Ngongotaha. Lake-terrace soil.
Series A. Rotorua Shower Series, containing no Basic Scoria.												
1. Fine Gravelly and Coarse Sands, Lakeside.												
T 562	Fine gravelly sand	..	18.3	44.8	10.6	9.6	4.2	1.3	2.2	9.5	5.3	Dudley Road, Te Pu. Forest on ridge.
564	"	..	23.2	46.6	9.9	8.7	3.5	0.9	1.4	6.5	Trace	Dudley Road, Te Pu. Fern slopes.
566	"	..	22.3	40.2	14.0	9.6	3.6	1.0	1.4	7.7	7.7	Dudley Road, Te Pu. Lower slopes, fern and grass.
568	"	..	17.3	37.8	17.9	12.5	4.6	1.0	1.0	7.4	4.5	Dudley Road, Te Pu. Higher level area, old grassed clearing.
616	"	..	26.3	26.6	16.1	12.9	4.4	1.2	5.2	9.0	11.1	Kaharoa Road. Fern flat.
618	"	..	23.8	35.5	13.9	10.4	3.3	0.7	3.9	8.5	5.3	Rotongata Road, Kaharoa.
620	"	..	20.3	49.0	11.3	8.5	3.0	0.5	1.1	6.2	7.4	Junction, Rotongata and Te Waerenga Roads.
622	"	..	35.0	26.1	12.1	9.9	4.0	0.7	1.7	10.9	12.5	Te Waerenga Road. Fern and grass.
624	"	..	32.2	23.3	12.2	10.2	3.8	0.7	1.7	7.9	14.8	Te Waerenga (half-mile from road). Poor grass.
S 472	"	..	16.6	40.2	14.3	10.5	5.4	1.1	2.5	9.2	12.8	Kaharoa Road, Kaharoa.
T 84	"	..	18.1	40.9	12.3	10.1	7.5	1.2	1.8	7.4	15.4	Block VI, Rotoiti S.D.
T 176	"	..	21.5	53.4	7.5	8.4	3.8	1.3	1.3	5.1	11.8	Blocks VII and VIII, Rotoiti S.D.
S 475	"	..	16.7	48.7	12.0	8.8	5.0	0.8	0.8	7.1	9.2	Kaharoa. End of Kapakapa Road. Contains less pumice and more volcanic glass.
2. Fine Gravelly Sands, Kaharoa.												
3. Intermediate between Coarse Sandy Silts and Fine Gravelly Sands, Kaharoa.												
T 806	Between coarse sandy silt and fine gravelly sand	16.3	31.8	20.0	14.3	4.3	0.8	1.3	9.9	5.9	5.9	Kaharoa Road, near junction Main Road.
529	Ditto	..	22.2	24.9	14.8	13.7	4.8	1.6	3.3	13.5	16.0	Pasture, Hamurana.
570	"	..	22.7	29.0	14.5	12.5	5.1	1.3	2.8	7.8	8.7	Kakahi Village. Rough pasture, fern and blackberry.
572	"	..	20.4	33.1	16.3	15.1	3.9	1.5	1.1	8.7	7.5	Junction, Rotorua and Roy Roads, Te Pu. Rimu-tawa forest.
580	"	..	18.1	34.3	18.1	12.3	7.1	0.9	0.9	8.4	9.1	Lagoon Road, Te Pu. Rimu-tawa forest.
582	"	..	27.3	29.9	12.2	13.1	5.8	1.8	1.3	7.8	Trace	Lagoon Road, Rimu-tawa forest.
592	"	..	16.3	36.4	18.9	14.3	5.2	1.2	1.5	6.2	5.5	Dudley Road, Te Pu. Grass flat.
612	"	..	23.3	28.6	13.8	13.2	5.3	1.3	3.4	10.5	7.4	Tauranga-Rotorua Road, Te Pu. Good pasture.
627	"	..	23.1	27.0	17.6	11.1	4.6	0.8	4.6	10.9	9.5	Te Waerenga Road, Kaharoa. Forest.
S 469	"	..	14.7	35.1	17.9	13.0	5.0	3.1	2.4	9.2	16.8	Kaharoa, above Hamurana.

TABLE 7. MECHANICAL ANALYSES—continued.

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.	Remarks.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.

Series A. Rotorua Shower Series, containing no Basic Scoria—continued.

5. Sandy Silts, Rotorua and Mamaku—continued.

511	Sandy silt	2.9	29.1	25.5	17.8	4.8	0.7	5.3	12.6	Trace	No. 1, No. 2A, Block IV, Horohoro S.D.
313	"	2.6	26.6	26.1	19.4	6.0	0.7	3.4	13.9	Trace	No. 1M, No. 3, Block IV, Horohoro S.D.
355	"	3.5	29.0	27.3	16.7	3.3	0.4	5.6	12.8	2.7	Ngongotaha Mount Road. Bush.
493	"	4.1	30.9	28.0	20.9	4.1	0.9	1.8	8.5	4.5	No. 2B, No. 1, Block XII, Rotorua S.D.; Junction, Oturoa and Hamurana Roads.
495	"	3.7	28.6	29.6	18.0	4.2	0.8	2.4	11.3	2.7	No. 2W, Block XII, Rotorua.
669	"	4.3	19.1	28.2	23.8	6.4	0.7	4.0	12.4	5.9	Ngongotaha. Junction of Oturoa Road.

6. Sandy Loams, Oturoa.

466	Sandy loam	0.8	19.2	24.2	20.9	7.0	5.0	7.4	14.0	6.3	Oturoa. Beech forest.
499	"	0.8	16.3	20.9	19.8	8.7	5.5	9.5	18.4	Trace	Oturoa Road, Section 10, Block X, Rotorua S.D.
68	Loam.	1.6	8.8	14.3	22.8	15.8	3.5	6.3	27.3	9.5	Oturoa Road, Section 10, Block X, Rotorua S.D.
69	Neither a sandy silt nor a sandy loam, but nearer the latter	0.9	15.6	26.6	23.4	9.6	3.2	5.1	13.0	1.9	Oturoa Road, Section 8A, Block X, Rotorua S.D.
661	Sandy loam	1.4	18.0	23.4	20.7	10.5	4.8	4.3	16.1	Trace	Lichfield—Oturoa Road. Pasture.
663	"	1.0	15.4	23.3	20.9	12.0	4.2	6.3	16.1	2.9	Lichfield—Oturoa Road, Section 5A, Block X, Rotorua S.D.
665	"	1.5	18.1	22.2	23.5	7.9	5.2	5.4	15.8	Trace	Lichfield—Oturoa Road, Section 5, Block X, Rotorua S.D.
667	"	1.4	14.0	20.7	20.3	12.3	4.0	6.7	18.7	6.5	Oturoa. Pasture, near Waipi Tramway.

Series B. Old Tarawera Eruption Series, containing Basic Scoria.

Type 1. Coarse Sands, Ngawaro-Rototi.

498	Coarse sand	14.5	54.7	11.5	9.0	4.7	1.1	0.4	4.1	22.2	Rototi Station. On ridge.
481	"	8.6	43.8	18.0	12.3	4.2	2.3	1.8	8.6	4.1	Ngawaro. Junction, Mangatou and Main Roads.
501	"	9.2	49.9	14.3	10.9	6.3	1.5	1.4	6.4	9.6	Rototi Station. Slopes of gullies.
484	"	10.6	43.6	18.4	10.1	7.0	1.2	1.7	8.6	19.6	Matai Road. Forest.

T	72	"	"	"	13.2	50.3	14.5	7.5	4.3	1.1	1.9	6.0	11.1	Block X, Rototiti S.D.
173	"	"	"	"	10.0	45.0	15.3	13.1	6.0	1.4	1.9	5.5	7.1	Blocks VII and VIII, Rototiti S.D.
174	"	"	"	"	14.8	46.0	14.3	12.5	4.9	1.6	2.0	5.1	10.8	Blocks VII and VIII, Rototiti S.D.
175	"	"	"	"	6.9	46.3	13.9	10.4	7.3	1.3	4.2	9.4	11.1	Blocks VII and VIII, Rototiti S.D.
176	"	"	"	"	7.2	34.8	13.7	9.2	5.4	1.0	0.8	5.0	5.0	Blocks VII and VIII, Rototiti S.D.
177	"	"	"	"	8.3	35.8	15.4	9.6	5.4	0.8	0.7	3.8	6.7	Blocks VII and VIII, Rototiti S.D.
178	"	"	"	"	6.9	30.4	16.3	10.1	4.4	1.1	1.9	8.3	11.8	Blocks VII and VIII, Rototiti S.D.
179	"	"	"	"	5.6	36.3	13.1	8.6	5.4	1.7	1.7	4.9	6.4	Blocks VII and VIII, Rototiti S.D.
180	"	"	"	"	8.4	44.0	16.8	11.5	0.5	1.3	1.7	9.3	1.8	Otanewainuku. Flat-topped ridges, lower slopes.
606	"	"	"	"	9.4	47.9	15.8	9.5	6.4	1.1	1.5	8.0	2.0	Whataroa Road, Ngawaro.
594	"	"	"	"	10.4	48.8	11.6	12.2	5.6	0.9	2.9	7.4	Trace	Mangatō Road, Ngawaro.
595	"	"	"	"	6.8	57.5	14.4	10.3	3.7	0.8	1.1	5.5	Trace	Otanewainuku. Higher slopes. Pasture.
600	"	"	"	"	10.0	49.4	12.2	11.6	4.9	0.7	1.8	8.3	Trace	Mangatō Road. One mile from Main Road, Ngawaro.
602	"	"	"	"	10.5	40.2	16.6	12.1	5.1	0.7	1.0	7.8	2.6	Junction, Mangatō and Roturua Roads. Forest.
70	"	"	"	"	13.7	52.6	13.1	7.8	4.5	1.1	1.3	6.2	22.0	Hongi's Track. Forest.
78	"	"	"	"	5.6	50.7	22.8	9.7	4.3	1.1	1.0	5.0	4.5	Rotoma S.D. Forest, near W/76.
82	"	"	"	"	10.3	53.1	17.0	8.4	4.7	0.7	0.7	4.8	5.7	Section 6, Block XVI, Maketu S.D. Forest.
84	"	"	"	"	10.1	48.1	16.0	10.9	4.2	1.3	1.4	8.0	4.0	Twelve miles from Okere towards Tauranga. Fern land.
86	"	"	"	"	14.0	45.0	17.1	10.6	4.9	1.1	0.8	6.5	3.2	Whataroa clearing, Matai Road. Eight miles from Main Road.
88	"	"	"	"	14.7	40.8	16.7	10.5	5.9	2.1	1.6	8.0	3.7	Whataroa clearing, Matai Road. One mile from Main Road.
604	"	"	"	"	5.2	47.4	10.1	11.9	4.9	1.2	2.5	7.1	Trace	Whataroa Road, Ngawaro. Lower flats.
608	"	"	"	"	10.5	56.5	11.8	8.3	4.7	0.4	2.2	6.5	Trace	Whataroa Road, Ngawaro. Pasture.
610	"	"	"	"	14.3	48.5	12.9	11.0	4.6	0.5	1.5	5.9	3.1	Whataroa Road, Ngawaro. Koromiko Clearing.

Type 2. Coarse Sandy Silts, Rototiti.

Series C. Recent Tarawera Eruption Series.

Type 1. Sandy Loams, Te Ngarua.

W	60	Sandy loam	..	6.4	13.4	23.5	22.7	12.6	8.4	1.7	6.7	19.0	Wairoa Road.
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Type 2. Fine Sandy Loams, Okareka.

W	62	Between a sandy loam and a fine sandy loam	5.2	13.0	36.6	22.0	12.1	6.0	1.1	3.8	40.6	Terrace by Lake Okareka. Fern, &c.
64	Ditto	..	5.1	15.4	39.2	18.9	11.7	6.3	1.0	2.3	33.3	Flat by Lake Okareka. Manuka.

closely approaches that of Series C, on which malnutrition disease never occurs. There is, however, an important chemical difference in that the Series C soils (Te Ngae district) contain material which yields a higher percentage of lime than the Oturoa lands. It is quite possible that the heavier Oturoa lands would respond to a dressing of carbonate of lime, the use of which is contra-indicated by experience in the case of coarser soils. The remarkable change in the composition of the plant-covering in both forest and undergrowth (fully described in this *Journal* for November, 1924, p. 333), which is correlated with the change in composition of the soil, is a fact worth noting. It is worthy of remark that where the beech forest spreads on to lighter soil on the Matai Road the subsoil where the tree-roots would be is still a heavy one, though the undergrowth whose roots would be in the soil mostly is of the same type as that growing on Type 5. Weight of cubic foot of moist soil (Type 6), 78.35 lb.

It is to be remarked that on all the types other than Nos. 1 and 6 of Series A the nutrition disease iron-hunger or bush sickness in ruminants develops as a natural sequence on surface-sown pasture on unploughed unfertilized land, and unless remedial measures are adopted all stock will become affected.

Series B.

This series, containing the No. 1 type of coarse sand, is a very large area to the north of Lakes Rotorua and Rotoiti. Sheep sometimes become affected on this country. These lands are likely to respond rapidly to proper treatment. The native vegetation is much the same as that on Series A, Type 2. They are quickly becoming settled. Area, 120 square miles. Weight of cubic foot of moist soil, 79.49 lb.

Series C.

These consist of two soil types, but there are three types of vegetation. At the lakeside where wet conditions prevail swampy forest of the pukatea (*Laurelia*) and white-pine (*Podocarpus dactyloides*) type occurs. On drier lands is a modified tawa-rimu forest, and interspersed with this, in a fashion which suggests old Maori clearings, fern and tutu largely predominate. Area, twelve square miles. • Weight of cubic foot of moist soil, 85.81 lb.

GENERAL.

The map which accompanies this article is but a preliminary map of the soils. It does not pretend at present to be a map showing the incidence of bush sickness, although with further investigation and inquiry it may well develop into such. A map of the subsoils is in course of preparation.

In the carrying-out of the work here recorded the writer wishes to acknowledge the zealous and able assistance of Mr. R. E. Grimmer, M.Sc., of this Laboratory, who has been in charge of the mechanical analyses and has designed apparatus for quickening the work (*N.Z. Journal of Science and Technology*, vol. 8, No. 2, 1926). Mr. Grimmer is to be stationed in the Rotorua County for some months in order to extend this survey into areas adjoining those already covered.

(To be continued.)

DISEASES IN FLOCKS AT LAMBING-TIME.

HINTS FOR SHEEP-FARMERS.

W. C. BARRY, M.R.C.V.S., District Superintendent, Wellington.

THE approach of the lambing season, with its concomitant troubles in ewe and lamb, suggests that reference to the commoner causes of mortality at this period might prove helpful to sheep-farmers by reminding them beforehand of the methods of prevention of such losses. The suggestions contained in the following notes are mostly a reiteration of the advice issued in past years on the subject by the Live-stock Division.

CONDITION OF THE EWE.

On the ewe's physical condition previous to the time of parturition depends to a great extent her ability to bring forth healthy lambs with a minimum of risk to the ewe herself. Indeed, if we exclude climatic conditions giving rise to mortality which cannot be avoided, and certain obstetrical difficulties met with occasionally which end in death, it will be found that by far the greatest loss is occasioned by a condition of the ewe not consistent with fitness during the weeks preceding lambing.

By fitness in the ewe is meant a state of constitutional vigour not impaired by excess of fat. This ideal condition can be obtained only through a properly regulated diet and sufficient exercise. By these means the natural tendency of the pregnant ewe to lay on too much fat is checked, and she arrives at parturition not in a plethoric state, but in sound, hard condition. Dietary plays an important part in sheep diseases, and in no instance more so than in the case of the pregnant ewe. If feed be too plentiful a close watch must be kept and the ewes changed to barer pasture, where the enforced exercise in obtaining sufficient feed will have its beneficial results. Forcing in-lamb ewes with too much dry feed—chaff, hay, &c.—brings about bad effects by producing high condition and consequent loss of exercise. Again, feeding turnips indiscriminately must be guarded against. Briefly, the desired end is obtained by variety and change of feed—"doing" the ewes wisely but not too well.

ANTEPARTUM PARALYSIS.

This is a common cause of mortality among ewes, more often seen in seasons when the conditions of feed favouring its development obtain. The predisposing cause is dietetic, leading to a fat, plethoric condition in the animal, which is followed by a semi-comatose state, paralysis, and death.

Symptoms: The trouble occurs at any time during the month preceding lambing. Usually the first thing noticed is one or more ewes lying in a dazed condition, unable to rise, apparently paralysed. Death soon follows. An inspection of the flock will probably reveal further cases in an earlier stage, in which the animals are reluctant to move, take little or no notice of man or dog, and, if hustled, usually fall over.

On opening the carcase an overfat condition of the internal organs is seen—large deposits of fat around the kidneys; the liver is enlarged, of a pale colour, very fatty and friable, and its substance can readily be broken down by the fingers. In practically all cases it will be observed that the ewe was carrying twin lambs.

Treatment: Medicinal treatment of badly affected ewes is useless, as when once symptoms are advanced the disease is invariably fatal. On the other hand, preventive treatment is entirely satisfactory. Remembering that the cause operating is common to the whole flock, it may be expected that when a few deaths from this disease occur more will follow unless preventive methods be at once put in action. An immediate change of pasture for the whole flock is indicated—to barer feed if possible. Enforced exercise by rounding up of the flock and keeping the ewes on the move for an hour daily, driving them slowly, and not allowing them to be hustled by dogs practically always has the effect of stopping the mortality. After lambing, the danger from this disease is over.

EXTRUSION OF THE VAGINA.

Extrusion of the vagina in ewes before lambing (commonly termed "putting out the bearing") is a condition which in some seasons gives rise to considerable anxiety and loss.

The trouble is usually ascribed to the same cause as gives rise to antepartum paralysis—a too fat condition of the ewe. This is not always apparent, and one frequently hears it said that affected ewes were not to be described as overfat. The predisposing influence, however, appears to be primarily a seasonal one, consensus of opinion being that in seasons when feed is plentiful the ewes do not take sufficient exercise, resulting in sluggishness, fatty infiltration of the liver, and infrequent urination, causing distension of the bladder, ending in extrusion of the vagina. The incidence of the trouble is low in seasons when, owing to an unfavourable winter, feed is scarce, and the ewes being forced to travel for their feed are beneficially influenced by the exercise entailed.

The older the ewe the more likely is the trouble to occur. Ewes carrying their first lambs are not often affected. Its occurrence later is probably explained by the fact that in ewes which have already given birth to lambs the attachment of the vaginal walls has become more relaxed, and consequently the membrane is readily everted on straining. Spasm of the neck of the bladder, resulting from continence of urine, has also been referred to as a probable cause. Eversion of the vagina, as a rule, occurs in ewes carrying twin lambs.

Symptoms: The ewe shows uneasiness and straining. The "bearing" is seen protruding, and if long everted before being observed the parts are swollen and congested. The condition generally occurs within the week preceding lambing.

Treatment: If seen early, the "bearing" can be successfully returned. A sedative dose of two teaspoonfuls of laudanum in a little gruel is administered to the ewe. The hands and arms of the operator are washed in an antiseptic and oiled. The ewe is then placed on her side, the extruded membrane is washed with warm water which has been previously boiled (the use of strong antiseptic irritates the membrane and only induces further straining), and is

then carefully returned by the hand into the passage, and held there until warm. A few stitches are then usually inserted across the lips of the part, and the ewe is kept from movement for a time. In some districts a truss is used for this purpose, and is said to give good results. If straining be renewed, the dose of laudanum can be repeated after a few hours. A dose of 2 oz. of castor-oil given later will prove beneficial.

If the everted parts are much congested and inflamed before the animal is seen their return is, of course, rendered much more difficult. To be successful treatment must be adopted early, and then, as a rule, it is followed by safe lambing.

Prevention: Best results are obtained by frequently changing the ewes, thus enforcing plenty of exercise. A change on to young grass, by its laxative effect, greatly lessens the susceptibility to this most troublesome condition.

PROLAPSE OR EVERSION OF THE WOMB.

This accident follows lambing, but is not a commonly seen condition. It may be due to unusual spasm attending delivery, but it more often follows manual extraction of the foetus in cases in which to rectify some wrong position assistance had to be given.

To return the womb the ewe is placed on her back. Two persons elevate the hind quarters by raising the hind limbs. The womb is then carefully cleaned and washed, any parts of the cleansing still attached removed, and the organ returned, commencing at the part nearest to the animal. As reduction proceeds, the fist is placed in the centre of the everted uterus, and as the latter slips back to the pelvic cavity it is followed up by the arm, which is kept in that position for a time. A few strong stitches are then inserted across the lips of the vulva, and the ewe may receive a dose of laudanum. The animal is kept as quiet as possible for a time, and should later be given a dose of castor-oil.

METRITIS OR INFLAMMATION OF THE WOMB.

Localized cases of inflammation of the womb, generally following a difficult lambing, are sometimes met with. The trouble is indicated by high temperature, quick breathing, and frequent straining, with a varying amount of discharge from the womb. Such cases should be isolated, the womb washed out with a solution of peroxide of hydrogen (one part to six of warm water), and the ewe treated to an opening dose of medicine, such as 4 oz. of Epsom salts with two teaspoonfuls of ginger dissolved in a pint of water.

GANGRENOUS MAMMITIS.

Fortunately not often met with, this is one of the most fatal diseases of the ewe. One-half of the udder becomes swollen, hard, and painful, and a blood-stained secretion may be drawn from it. The affected half of the gland rapidly becomes almost black in colour, gangrene sets in, and the skin of the udder sloughs away, as also does the skin along the belly. Death follows in a few days from blood-poisoning.

Treatment of individual cases should not be attempted. Being due to a germ and highly contagious, prevention of spread is the main object. This is best secured by slaughter of affected ewes and burning of the carcasses. The entire flock should be removed to clean pastures, and contaminated paddocks either ploughed or kept free from sheep.

STOMATITIS (SORE MOUTH) IN LAMBS.

Lambs are occasionally affected with a form of sore mouth in which the lips swell and eruptions appear on the gums, palate, and tongue. The infection is spread to the teats and udders of the ewes by the lambs in suckling. The complaint does not cause serious systemic disturbance beyond a certain amount of loss of condition in the lambs through difficulty in feeding.

In treatment we have had quick results from the application to the lambs' mouths of an ointment made by mixing one part of sulphur with eight parts of vaseline. Smearing the ointment on the lamb's mouth plentifully, it will in turn be applied to the lesions of the ewe's udder by the lamb in suckling.

DIARRHŒA IN LAMBS.

This trouble sometimes occurs a few days after birth. It may be due to improper feeding of the ewes or to a contaminated condition of the pasture where lambing has taken place.

Treatment would indicate a change of feed for the ewes. It may be necessary in bad cases to separate the lambs from their mothers, feeding them with boiled milk. A teaspoonful of castor-oil to the lamb is useful. The shepherd's remedy of preparing rice-water in which a few raw eggs have been beaten up, and giving a wineglassful to each lamb affected with scouring, is often all that is required.

RUST IN PASTURE AND LAMBING.

It has been stated by sheep-farmers that prevalence of rust in grass is a cause of poor percentage of lambs, and at last year's annual conference of the Royal Agricultural Society the Department of Agriculture was requested to investigate the subject. An investigation was accordingly carried out by the various District Superintendents, who are qualified veterinarians, but they were unable to secure any data in confirmation of the statement in question. As pastures in the Hawke's Bay District were badly affected with rust that year, an Inspector of Stock specially visited a number of farms in the district to note the incidence of rust during the period when the rams were out with the ewes. In the ensuing lambing season the inquiry was followed up by this officer in connection with the same farms. He was unable, however, to glean any information that would justify him in stating that rust had affected the percentages of lambs. Even where the ewes were running on badly rusted pastures the percentages were well up to average.

Plant-bug attacking Turnips.—In January last a Marlborough correspondent forwarded specimens of an insect which was attacking turnip-plants just coming into rough leaf. The insect was identified by the Department's Entomologist as *Nysius huttoni*, a native species of plant-bug which punctures the tissues of a great variety of plants and sucks the sap, but which so far could not be regarded as a major pest. It is commonly found on turnip crops throughout New Zealand each year, even where no sign of injury is evident.

PARASITES OF THE PEAR-MIDGE (*Perrisia pyri*).

FIRST ATTEMPT AT THEIR ESTABLISHMENT IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

In former articles published in this *Journal* on the pear-leaf-rolling midge (*Perrisia pyri*) the habits, distribution, and life and seasonal histories of the insect, as well as control experiments, have been dealt with by the present writer, and by Dr. R. H. Makgill, of Henderson. The present record sets out the results to date of the first attempt to introduce from Europe and establish in the Dominion insect parasites of the midge.

A difficulty at the outset was that, though a major pest in New Zealand, the midge is considered of but little account in Europe, where it has not attracted much attention. Therefore but little was known concerning the midge itself before its investigation in New Zealand was commenced during 1920, and almost nothing regarding its parasites until the matter was taken up in France last year. Prior to this the only information available concerning possible parasites was that a parasitic hymenopterous insect named *Inostemma pircicola*, well known as a parasite of a species of pear-midge (*Contarinia pyrivora*) allied to *Perrisia pyri*, but attacking the pear fruit and not the leaves, had been reported by R. G. Mercet as having been reared also from *P. pyri*. In view of the recent investigations in France, however, there seems to be a possibility that this *Inostemma* is not *I. pircicola* but a species as yet unnamed.

SEARCH FOR PARASITES IN FRANCE.

In 1925, since *Inostemma pircicola* was the only known possibility at the time, and since it was a well-known parasite of the pear-fruit midge (*Contarinia pyrivora*), it was decided that an attempt should be made to secure this parasite from Europe for establishment in New Zealand. Through the Imperial Bureau of Entomology, London, the services of Dr. R. C. Fisher, of the Ministry of Agriculture, were secured. Dr. Fisher, though engaged on other work in France at the time, was good enough to undertake free of charge the collection of a consignment of pear fruit infested by *C. pyrivora* parasitized by *I. pircicola* for transmission to New Zealand. While engaged in the pear-orchards at Bordeaux Dr. Fisher located an infestation of the leaf-rolling midge (*Perrisia pyri*), and found that this insect was being parasitized by another hymenopterous insect, an unknown species of the genus *Platygaster*. As will be noted later this was of considerable importance.

Dr. Fisher secured a considerable quantity of midge-infested pears in the hope that the parasite *Inostemma pircicola* would be also present, and despatched the material under cool storage to New Zealand, where it arrived on 25th August of last year. This material, however, was found to be in a very dry condition, and the pears hard and woody.

In some of the specimens cut open for examination dried remains of midge-larvæ were found. Though not much hope was entertained of parasites being reared from this consignment, the material was kept moist and in cool storage in the laboratory until the leaf-rolling midge (*P. pyri*) was due to emerge in the spring from hibernation in New Zealand. This will in future be referred to as the "first consignment."

Owing to Dr. Fisher's duties with the Ministry of Agriculture preventing him carrying on the work of securing midge parasites at that time, Mr. J. G. Myers, of this Department, who was then in North America, was commissioned to proceed to Europe and make as extensive a search for suitable parasites as time would allow. For about seven weeks during July and August (1925) he studied the problem in Europe, mainly in the vicinity of Paris, where he had the double advantage of having at hand pear-orchards infested with the leaf-rolling midge, and of Dr. Paul Marchal's assistance and "valuable advice in an investigation closely related to his own classical researches."

Mr. Myers succeeded in locating three types of parasites of the leaf-rolling midge, all of which are as yet unidentified hymenoptera—namely, (1) a species of *Inostemma* closely resembling the *I. piricola* already referred to, (2) the species of *Platygaster* discovered by Dr. Fisher, and (3) a number of metallic-green chalcidoids of different sizes, which may or may not belong to the one species. He found that both the *Inostemma* and *Platygaster* parasitize the eggs of the midge, and that their larvæ are internal parasites of the midge-larvæ, while the larvæ of the chalcidoids are external parasites of the latter. He also reported that the *Platygaster* parasitized as much as 58 per cent. of the midge-larvæ. It may be that the *Inostemma* bred from *Perrisia pyri* by Mercet, and identified by him as *I. piricola*, is really the same species as the unidentified *Inostemma* found by Mr. Myers, and not *I. piricola*.

Mr. Myers secured a quantity of pear-leaves infested by the leaf-rolling midge and its parasites, packed the material in moist sphagnum moss, and sent it to New Zealand in cool storage. It arrived at Auckland in good condition on 8th October last, and on receipt was again placed in cool store. This will in future be referred to as the "second consignment."

On Mr. Myers returning to America, Dr. Fisher, who was then free, undertook to carry on the work in France. This was done in October, but owing to the lateness of the season but little midge material could be found. Nevertheless a small consignment was secured from localities where the three above-mentioned parasites were still at work, and sent packed in moist sphagnum moss to New Zealand. This was received here early in December. Before shipping, Dr. Fisher examined some of the midge-larvæ and found the *Platygaster* appearing "as a very young embryo or extremely early larval stage. It appeared as a kind of cyst, circular in shape, and apparently could occur in different portions in the body of the host." This second shipment from Dr. Fisher will in future be referred to as the "third consignment."

DESCRIPTIONS OF THE PARASITES.

In order to give some idea of what the three species of parasites mentioned look like it may be noted that they all belong to the order of insects known as the *Hymenoptera*, which also includes such familiar forms as wasps, bees, and ants. A considerable proportion of the members of this order are parasitic upon other insects, and they range in size from extremely minute to comparatively large species. All are possessed of two pairs of membranous wings supported by several, few, or even no "veins," according to the species. The three parasites in question are small insects, and their wing-venation is not well developed.

The female members of the genus *Inostemma* are very easily recognized by the peculiar horn-like process that projects from the upper surface of the abdomen, where it forms a "waist" at its junction with the thorax. This process curves forward over the back of the insect toward the head. Each forewing is supported by a single short "nerve," ending in a slightly swollen end (Fig. 1).



FIG. 1. FEMALE OF GENUS *INOSTEMMA* SHOWING CHARACTERISTIC ABDOMINAL PROCESS.

Small line beneath insect denotes natural size.

[After Ashmead.]

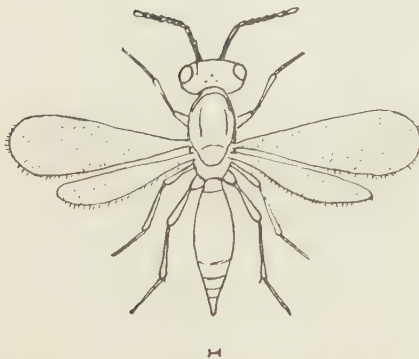


FIG. 2. FEMALE *PLATYGASTER*.
Small line denotes natural size.



FIG. 3. *CHALCIDOID*.
Small line denotes natural size.

[Original]

The *Platygaster* mentioned is a small black insect with a rather pointed abdomen. Its wings are unsupported by any "nerves" (Fig. 2).

The chalcidoids found attacking the pear-midge are somewhat larger and of a brilliant metallic-green colour. Each forewing is supported by a single "nerve" that extends to the fore border; from near its extremity the "nerve" gives off a short branch (Fig. 3).

Establishment in New Zealand.

The work of establishing the parasites necessitated constant daily attention, and Mr. J. Muggeridge, of this Laboratory, co-operated with the writer in observing and handling them.

METHODS EMPLOYED.

For the purpose of establishing the parasites and for their safe handling, to ensure that nothing other than the species required should be liberated—as it was expected that from the consignments sent insects other than parasites, which might escape and become injurious, would develop as well—a specially constructed outdoor insectary was erected over a small midge-infested pear-tree in Mr. W. G. Williams's orchard at Henderson, Auckland. This insectary (Figs. 4 and 5) consists of a wooden framework covered on the north, east, and west sides with 100-mesh wire gauze. The south side is boarded over with tongued-and-grooved timber, lined on the inside with a sheet of asbestos, and, as a protection from weather, with Ruberoid on the outside. In this end is a narrow wooden door lined with asbestos on the inside, and protected on the outside by a porch and outer door, both covered externally with Ruberoid. The inside of the porch is painted black, and into it both doors open. The roof has a low pitch, and is a wooden frame supporting panes of translucent glass. Wooden eaves project from the margins of the roof. The gauze on the three sides does not reach the ground, the sides being boarded all round to a height of about 1 ft.; this boarded portion is also continued into the ground and lined on the inside with asbestos. The exposed wood of the framework is painted white. When necessary the number of midges in the insectary was augmented by securing supplies by means of emergence-tents pitched in the orchard.

A number of emergence-boxes were made similar to those designed and used for parasite work in the United States. Each consists of a strong, oblong, shallow box, along one side of which holes are bored for the reception of the glass tubes and the securing of insects emerging as they come to the light. Each box is closed by a wooden lid, and also, beneath this, by a close-fitting glass lid on a wooden frame (Fig. 6). A very useful type of emergence-box for small quantities of material was made from wooden boxes used for the storage of half-plate photographic negatives (Fig. 7). Two holes were bored in one side for insertion of emergence-tubes. The mouth of the box was closed, after the parasitized material had been inserted, by a square of glass corresponding to the glass lid of the larger boxes, supported on a narrow wooden shelf nailed inside to each end of the box just

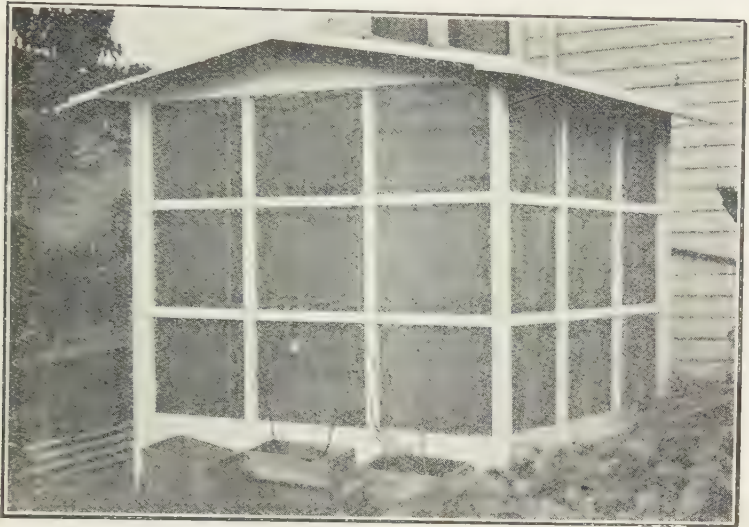


FIG. 4. TYPE OF INSECTARY ERECTED OVER CAGE AT HENDERSON.

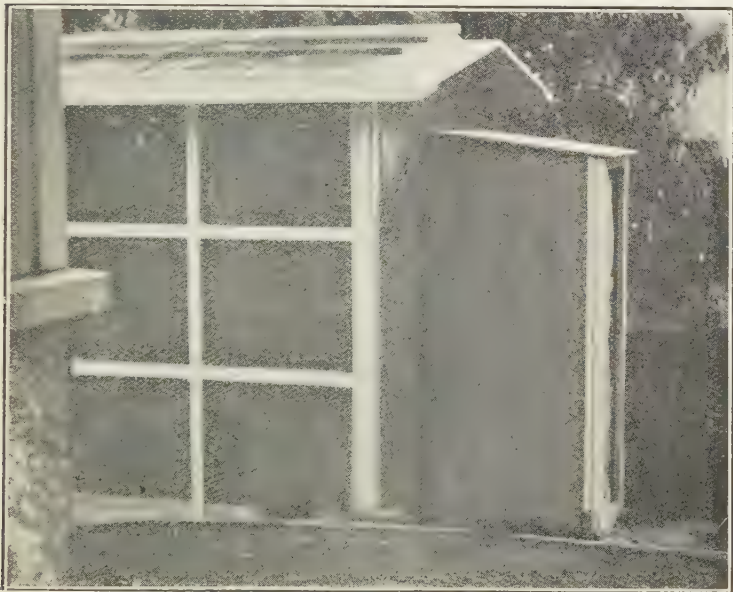


FIG. 5. PART OF SAME INSECTARY SHOWING PORCH.

[Photos by H. Drake.]

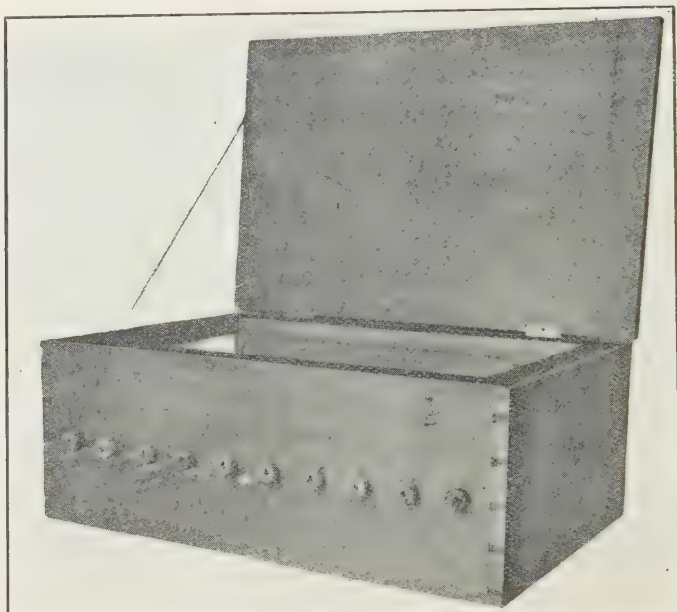


FIG. 6. LARGE EMERGENCE-BOX.

Note spraying-nozzle in centre plugged with cotton-wool.

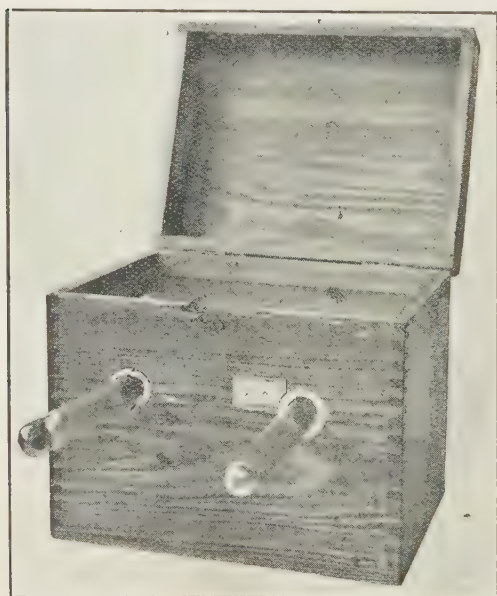


FIG. 7. SMALL EMERGENCE-BOX ADAPTED FROM A HALF-PLATE PHOTO-NEGATIVE STORAGE BOX.

[Photos by H. Drake.]

below the edge of the mouth. The glass was held in position and the box rendered insect-proof by means of odourless plasticine used to seal the glass in position.

Material from which parasites and other insects were emerging in the emergence-boxes was kept suitably moist by means of a fine spray of water. In order to do this without risking the escape of even minute insects the following method was devised: One of the glass emergence-tubes near the centre of each box was replaced by a piece of 4 mm. glass tubing about 4 in. long, having the end inside the box drawn out in the form of a slightly bent nozzle with a small aperture. Though there was but little chance of even minute insects first finding and then getting through the aperture of this nozzle, the outer end of the tubing, when not being used, was kept plugged by a piece of cotton-wool (Fig. 6). When applying water to the material in the boxes the exit-tube of a wash-bottle was connected by a length of rubber tubing with the outer end of the glass nozzle. The water was then blown into the latter, and when the wash-bottle was held above the level of the emergence-box a stream of water siphoned through into the box and was delivered as a spray through the narrow aperture of the nozzle. The nozzle being slightly bent, the water could be distributed over a broad crescentic area from end to end of the emergence-box by slowly turning the cork carrying the nozzle.

In order to study the habits of the parasites on their emergence from the imported material, glass lamp-chimneys having the ends closed with fine muslin, and each chimney enclosing a pear-shoot having opening leaves upon it, were used. The type of chimney giving the best results is that shown in Fig. 8. It will be noticed that there is a series of holes through the glass toward the bottom. Each hole was kept plugged with cotton-wool wrapped in cigarette-paper, and when an insect was to be inserted one of the plugs was removed and the mouth of the emergence-tube containing the insect applied to the opening. By this means the chances of an insect escaping were reduced to a minimum. Without these holes one of the muslin caps closing the ends of the chimney would necessarily have to be removed and again replaced, giving ample opportunity for the escape of any insect.

These chimneys were used in two ways: Some were suspended from the roof of the insectary, and enclosed shoots of young trees kept growing in boxes; others, with the upper end only closed with a muslin cap, were stood upon and sealed with odourless plasticine to squares of strawboard, each square holding a chimney having a central perforation. Through the latter and sealed there with plasticine a shoot cut from a pear-tree projected into the chimney, and its other end was immersed in a bottle containing water. Shoots enclosed thus kept fresh, and even developed leaves, for over six weeks.

For some time prior to the appearance of the first parasites a constant supply of pear-midges was kept emerging from emergence-boxes and allowed to infest pear-leaves enclosed in glass chimneys. In this way supplies of midge eggs and larvæ were available for any parasites when they should appear, when it would be possible to segregate the different types and test each separately.

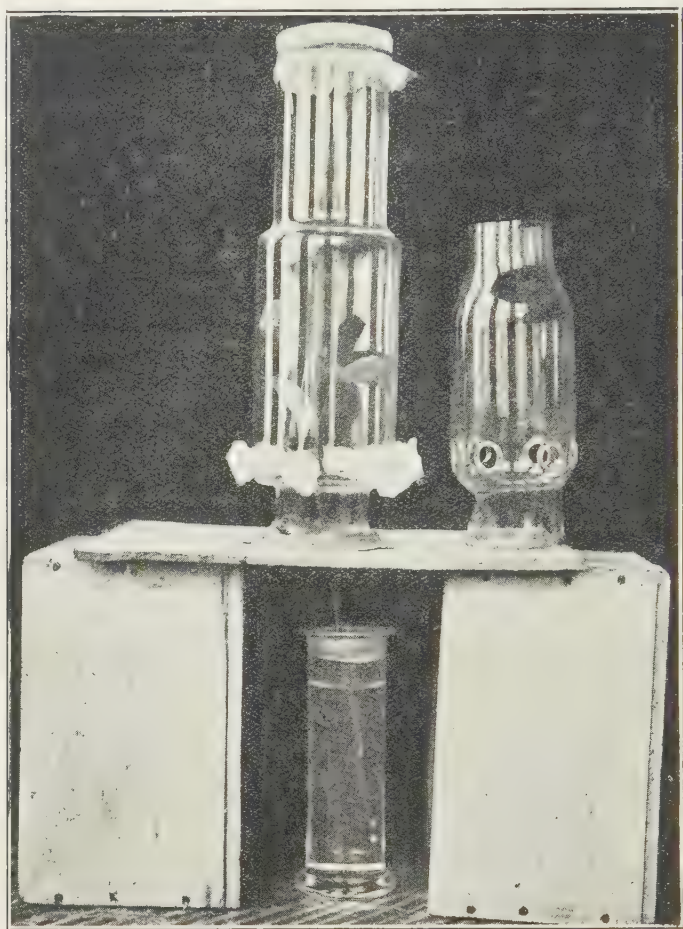


FIG. 8. LAMP-CHIMNEYS USED TO ENCLOSE PEAR-SHOOTS FOR OBSERVING PARASITES.

On right is a small chimney showing side holes unplugged.

[Photo by H. Drake.]

EMERGENCE OF PARASITES.

First Consignment.

This material was removed from cool storage on 1st September and placed in emergence-boxes "A." But though kept moist and under observation well on into January no parasites or even midges (in this case the fruit-midge, *Contarinia pyrivora*) emerged. All the pears were then opened up and examined, and the dried remains of insect larvæ were found in a few.

Second Consignment.

This consignment arrived in New Zealand on 8th October, and was immediately placed in cool storage. On the 9th a portion of this

material was removed from cool storage and placed in emergence-box "B." During the following three months the only insects developing from this were a predaceous-beetle larva and six midges, none of which was the pear-midge (*Perrisia pyri*), but a species apparently breeding in the sphagnum moss used for packing.

On 28th October another portion of the second consignment was taken from cool storage and placed in emergence-box "C." From this up to the end of January the only insects developing were eight midges, six of which were similar to those emerging from box "B," and two pear-midges (*Perrisia pyri*).

On 18th November a third portion of the second consignment was taken from cool storage and placed in emergence-box "D." On this date a predaceous-beetle larva, similar to the one appearing in emergence-box "B," was captured from box "D."

The following records made between 29th November and 16th December inclusive refer to insects emerging from box "D":—

November 29th: One midge (not *Perrisia*) emerged.

November 30th: Three midges (not *Perrisia*) emerged.

December 7th: Between November 30th and this date there were no emergences, when the first parasite, a female *Platygaster*, was secured and preserved for examination. A number of midges, including a considerable percentage of *Perrisia*, also appeared.

December 8th: A number of midges, including *Perrisia*, and a species of parasite belonging to the hymenopterous group *Ichneumonidea* emerged. This ichneumonoid was destroyed, as it was not one of the types of parasites being searched for.

December 9th: Two female and one male *Platygaster* emerged, also an abundance of *Perrisia*.

December 10th: One female and one male *Platygaster* and several midges (including *Perrisia*) emerged. The three *Platygaster* that emerged on the previous day were now liberated upon a pear-shoot (covered by a glass chimney) upon the young leaves of which midges were and had been ovipositing. This was numbered "Lot 1." The two parasites secured on this date were similarly placed on "Lot 2." The parasites, on liberation, immediately commenced searching for midge-eggs, feeling the leaves with their antennæ, or forcing these appendages between the folds of the leaves. When a batch of eggs was located the parasites oviposited in them, working rapidly. Many of the midge-eggs were laid among the epidermal hairs of the leaves and leaf-petioles, so that the movements of the parasites were readily followed.

December 11th: No parasites, but numerous *Perrisia* and other midges, emerged. In the report made by Mr. Myers on his work in France mention is made of an insect—a capsid bug—that he observed attacking the pear-midge larvæ. This bug is of quite a different type to the hymenopterous parasites already referred to, and belongs to the same order of insects as cicadas and aphids. On this date a bug appeared for a brief space in one of the emergence-tubes. However, before it could be secured it had retreated and was not observed to appear again either in the tubes or from among the moss in the box;

neither were its remains found when searched for in the sphagnum moss in March some time after any insects had ceased to emerge. It is possible that this bug was the species of capsid seen in France.

December 12th: No further parasite, but abundant midge (including *Perrisia*), emergence. The parasites placed on pear-shoots on the 10th (Lots 1 and 2) died on this date.

December 13th: No parasites and only a few *Perrisia* emerged.

December 14th: One female and one male *Platygaster*, a single specimen of the metallic-green chalcidoids (one of the three types being looked for), and several *Perrisia* midges emerged. This was the only occasion on which a chalcidoid appeared, and the specimen was preserved. The two *Platygaster* were liberated on pear-leaves upon which midges were ovipositing, and were numbered "Lot 3."

December 15th: No parasites, but *Perrisia* midges, emerged.

December 16th: No parasites, but a few *Perrisia*, emerged. On this date the remainder (half of total) of the second consignment was taken from cool storage and placed in emergence-box "E." The object in retaining most of the consignment until this date was that the greatest number of parasites would be secured at the period when the pear-midge had reached its maximum development for the season. As twenty-six days had elapsed from 18th November, when the third portion of the second consignment was placed in box "D," until 8th December, when the first *Platygaster* emerged, it was considered that, from material brought from cool storage about the current date, parasites should become available in less than twenty-six days, owing to the greater warmth of the season.

December 17th to 28th: During this period some *Perrisia* and a few other midges (but no parasites) emerged intermittently from box "D," but nothing from box "E."

December 29th: One female and one male *Platygaster* and a few *Perrisia* emerged from box "D." These parasites, the last to emerge from this emergence-box, were liberated on pear-leaves infested with midge-eggs, and numbered "Lot 4." No insects appeared in box "E."

The following records refer to observations concerning box "E," from which nothing so far had developed:—

December 31st: One female and one male *Platygaster* and a number of *Perrisia* emerged. In this instance fifteen days had elapsed before any parasites emerged after the material had been taken from cool storage: this was probably due to increase in temperature. The two parasites were liberated on the midge-infested tree covered by the insectary at Henderson.

January 1st (1926): Two female and one male *Platygaster* and several *Perrisia* emerged. The parasites were liberated on the tree in insectary.

January 2nd to 4th: During this period four female and two male *Platygaster*, together with several *Perrisia*, emerged, and the former were liberated on the tree in insectary.

January 5th: No parasites, but only a few midges, emerged.

January 6th: Two female and three male *Platygaster* were secured and liberated on tree in insectary. Several *Perrisia* also emerged.

January 7th and 8th: Several midges, but no parasites, emerged on these two days.

January 9th: Eight female and three male *Platygaster* were secured. There was also a slight increase in the number of *Perrisia* emerging. These eleven parasites, which were seen mating, were liberated in the midge-infested orchard in which the insectary stands at Henderson.

January 10th: No parasites, but only a few midges, emerged.

January 11th: Two female and one male *Platygaster* emerged, together with a few midges. The parasites were liberated in the orchard.

January 12th: Two female and two male *Platygaster* and an increased number of midges emerged. The parasites were liberated on the tree in insectary.

January 13th: One female and one male *Platygaster* and a few midges emerged.

January 14th: Three female and two male *Platygaster* and numerous midges appeared. These five parasites, together with the two that emerged on the previous day, were liberated on tree in insectary.

January 15th: Four female and one male *Platygaster* and numerous midges emerged.

January 16th: One female and one male *Platygaster* and a few midges were secured. These two parasites and the five of the previous day were liberated in the orchard.

January 17th to 21st: Four female and one male *Platygaster* emerged, and numerous midges. On the 18th, during this period, there was no parasite emergence. These five parasites were liberated on tree in insectary.

January 22nd to 26th: No emergence of parasites, and very few midges.

January 27th: One female *Platygaster* was secured and liberated on the tree in insectary. After this date there was no further emergence of parasites from the second consignment, though a few midges appeared at intervals during the following fortnight.

Third Consignment.

On arrival in New Zealand early in December this consignment was placed in two emergence-boxes—"F" and "G." From "F" only midges (no *Perrisia*), a species of chrysomelid beetle, and two species of tortricid moths developed. From box "G," besides the species of tortricid and beetle similar to those secured from box "F," the following parasites emerged:—

January 7th: One female and one male *Platygaster*; liberated on tree in insectary. Some *Perrisia* and other midges also emerged.

January 15th: Two female *Platygaster* and a few midges.

January 18th: One female and two male *Platygaster*, as well as a few midges, appeared. The parasites, together with the two secured on the 15th, were liberated on tree in insectary.

January 25th: One female *Platygaster* and two midges. The former was liberated on tree in insectary.

SUMMARY OF PLATYGASTER EMERGENCES.

Date of Emergence.	Number.		History.
	Females.	Males.	
(1.) From Second Consignment.			
1925.			
December 7 ..	1	..	Killed for examination.
" 9 ..	2	1	Put on <i>Perrisia</i> egg-infested leaves : Lot No. 1.
" 10 ..	1	1	Lot No. 2.
" 14 ..	1	1	Lot No. 3.
" 29 ..	1	1	Lot No. 4.
" 31 ..	1	1	Liberated on tree in insectary, Henderson.
1926.			
January 1 ..	2	1	Liberated on tree in insectary, Henderson.
" 2-4	4	2	" "
" 6 ..	2	3	" "
" 9 ..	8	3	Liberated in orchard, Henderson.
" 11 ..	2	1	" "
" 12 ..	2	2	Liberated on tree in insectary, Henderson.
" 13 ..	1	1	" "
" 14 ..	3	2	" "
" 15 ..	4	1	Liberated in orchard, Henderson.
" 16 ..	1	1	" "
" 17-21	4	1	Liberated on tree in insectary, Henderson.
" 27 ..	1	..	" "
Totals ..	41	23	
(2.) From Third Consignment.			
1926.			
January 7 ..	1	1	Liberated on tree in insectary, Henderson.
" 15 ..	2	..	" "
" 18 ..	1	2	" "
" 25 ..	1	..	" "
Totals ..	5	3	
Grand totals	46	26	

Of the complete totals of 46 females and 26 males, therefore, 1 female was killed for examination, 5 females and 4 males were placed with *Perrisia* egg-infested leaves (Lots 1-4) in the insectary, 15 females and 6 males were liberated in the orchard at Henderson, and 25 females and 16 males were liberated on tree in insectary at Henderson.

COMMENT ON PARASITE EMERGENCE.

The result of the emergence of parasites, based upon the number of species secured, shows that the material sent was most heavily parasitized by *Platygaster* sp., but little by the chalcidoids, and not at all by *Inostemma*—the three types of parasites for which we were on the lookout. It is possible, however, that, though only one chalcidoid and no *Inostemma* appeared, the conditions during transit favourable for *Platygaster* were unfavourable for the well-being of the chalcidoids and *Inostemma*.

Sunlight had a marked effect upon the *Platygaster*. On dull days there was no activity, but on sunny days the parasites became extremely active. Even though the *Platygaster* had emerged in the

emergence-boxes, very few, if any, would enter the glass collecting-tubes unless the latter were exposed directly to the sun. This influence of the sun was also noted in France.

The emergence of *Perrisia* and *Platygaster* in the emergence-boxes synchronized, the former insect usually being most numerous when the latter was emerging. It is to be noted also that a few *Perrisia* emerged before the first *Platygaster*, and, though the numbers fell off when no *Platygaster* were emerging, the midges did not cease altogether; and for some days after the last parasites emerged a few *Perrisia* appeared. The proportion of female *Platygaster* was considerably in excess of that of the males. The figures relating to the second consignment show that from the first emergence on 7th December until 4th January the numbers emerging were remarkably constant. From 6th January the daily emergences increased, reaching a maximum on the 9th, thereafter falling off considerably but keeping more or less constant until the 15th, after which date, until the 27th, when the last parasite emerged, the daily average was comparatively low. As the humidity in the emergence-boxes was kept as near constant as possible the above-mentioned fluctuation was no doubt influenced to a very great extent by increase of temperature.

The third consignment gave very poor results. This was no doubt due, as Dr. Fisher points out, to the difficulty of securing any quantities of *Perrisia* material, owing to the lateness in the season (October) when he undertook the work of collecting.

HISTORY OF PERRISIA EGGS PARASITIZED IN LOTS 1 TO 4.

The leaves of Lots 1, 3, and 4 were kept under close observation, and the midge-larvæ on leaving the leaves were given fine and moderately moist earth in which to pupate. It was found, however, that some preferred to spin the pupal cocoon (Fig. 9) among the dead pear-leaves, rather than burrow into the earth. The earth and leaves were secured

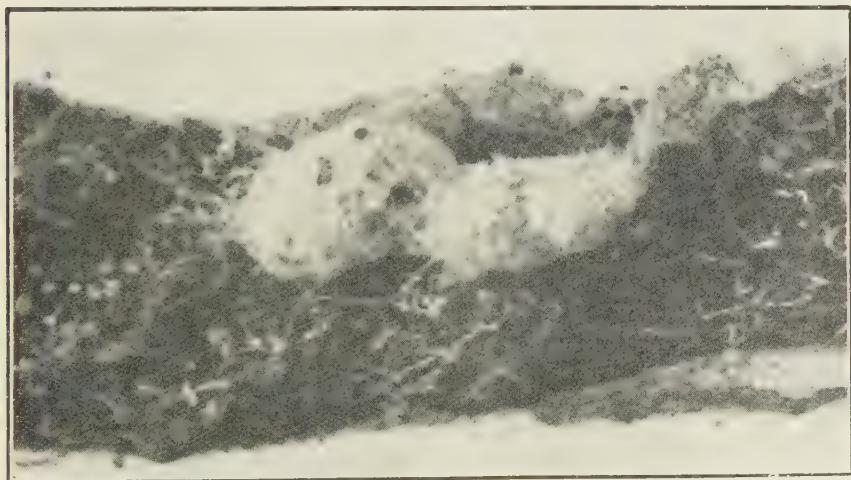


FIG. 9. COCOONS SPUN BY PEAR-MIDGE LARVÆ PRIOR TO PUPATION ON A DEAD LEAF. HIGHLY MAGNIFIED.

[Photo by H. Drake

in small emergence-boxes, but no parasites or even midges have emerged therefrom. A few midge-pupæ that remained among the dead leaves were examined microscopically, but no sign of parasites could be seen.

Ten midge-eggs found in the leaves of Lot 2 were carefully examined for parasite eggs, and in two cases what appeared to be such eggs were seen. Of five larvæ examined from this lot six days after hatching, a parasite larva was found in one of them.

¶ Owing to the limited number of *Platygaster* secured it was considered inadvisable to sacrifice more material for detailed examination, the main object in view being first the establishment of a parasite.

HISTORY OF PLATYGASTER LIBERATED ON TREE IN INSECTARY AT HENDERSON.

On the liberation of the *Platygaster* on the tree in the insectary at Henderson the females sought out the leaves infested with *Perrisia* eggs, and on finding batches of eggs commenced to oviposit in the same way as they had been observed to do in Lots 1 to 4. Mr. Muggeridge also observed the *Platygaster* actually piercing the *Perrisia* eggs during oviposition. Several lots of leaves containing midge-eggs, upon which, during oviposition, the *Platygaster* had been followed by Mr. Muggeridge, were removed from the tree just prior to the midge-larvæ pupating and placed in emergence-boxes. Though midges emerged in all cases, from only one (designated emergence-box "H") did four parasites emerge. These parasites were all male *Platygaster*. The history of this material in box "H" was that midge-eggs were parasitized on 13th January, the first male *Platygaster* emerged on 16th February, and the other three four days later.* This seems to point to the fact that the cycle of the *Platygaster* apparently corresponds with that of *Perrisia*, which takes approximately one month to develop from egg to adult.

Observations made in the Henderson cage during February, March, and April have failed to show any signs of living *Platygaster*, though several dead females were found entangled in spiders' webs. These dead parasites, however, might well have been some that had been liberated earlier from the emergence-boxes.

During this winter the tree in the insectary will be pruned so as to give a maximum growth of leaves next spring, when there should be an appearance of parasites as well as midges.

HISTORY OF PLATYGASTER LIBERATED IN ORCHARD.

In the Henderson orchards the *Perrisia* infestation this season had reached its maximum by the end of December, after which it showed a decided falling-off. The *Platygaster* liberated in the orchard on 9th, 11th, 15th, and 16th January, however, still had a fair supply of *Perrisia* eggs at their disposal, and were seen ovipositing in egg-infested leaves. Though the next brood of midges was comparatively nil, it is hoped that the *Platygaster* will have parasitized sufficient *Perrisia* to put in an appearance with the midge next spring.

* The development of only one sex from a batch of eggs is known to occur in other *Hymenoptera*. For instance, Jones recently recorded that the unfertilized eggs of a certain species always produced males (*Jour. Econ. Ento.*, vol. xix, p. 312, 1926).

ACKNOWLEDGMENTS.

To the efforts in France of Dr. R. C. Fisher, of London, and Mr. J. G. Myers, of this Laboratory, the success of the arrival in New Zealand of shipments of living parasites is due, as well as to the assistance and advice given by Dr. Paul Marchal, Director, Entomological Station, Paris, who is a noted authority. Dr. G. A. K. Marshall, Director, Imperial Bureau of Entomology, London, also rendered very considerable assistance.

For the safe transit of the parasites aboard ship we are indebted to the Shaw, Savill, and Albion Company, the Federal Steam Navigation Company, and the Commonwealth and Dominion Line.

Mr. W. G. Williams, of Henderson, has kindly put his pear-orchard at our disposal for establishment work. Our thanks are also due to Mr. W. Rice, Orchard Instructor, Auckland.

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TOP-DRESSING DEMONSTRATION AT MORTON MAINS.

In an endeavour to still further popularize the top-dressing of pastures in Southland an area of land was selected in July, 1925, and a small experimental area established on the farm of Mr. William Barron, at Morton Mains. The local branch of the Farmers' Union erected the necessary fencing, and did all other initial work required. The area was a pasture which had been down for eight or nine years and had never been top-dressed, although the land had been limed many years ago. When the area was taken over the dominant grass was brown-top (*Agrostis tenuis*); cocksfoot, crested dogtail, alsike, and white clover were present, but in a very weak condition.

The manurial treatments per acre were as follows: (1.) 44/46 superphosphate, 3 cwt. (2.) 44/46 superphosphate, 3 cwt.; carbonate of lime, 1 ton. (3.) 44/46 superphosphate, 2 cwt.; Nauru rock phosphate, 1 cwt.; sulphate of ammonia, $\frac{1}{2}$ cwt. In laying out the experiment the usual controls were provided, and each plot was made 5 chains long by $\frac{1}{2}$ chain in width. All plots were repeated, which gave a length of 10 chains by $\frac{1}{2}$ chain for each manurial treatment.

In the spring No. 3 treatment showed the earliest growth, but the other plots soon outdistanced it, and at time of weighing it did not compare favourably with the others either in weight or clover content. The weighings were taken from strips $\frac{1}{2}$ chain long by 4 ft. 6 in. wide, and the herbage in all cases was weighed as soon as it was cut.

Following are the average green weights of ten weighings for each plot: Control, 25.5 lb.; superphosphate, 47.6 lb.; control, 21 lb.; super, Nauru rock phosphate, and sulphate of ammonia, 38.5 lb.; control, 25.6 lb.; super and carbonate of lime, 54.3 lb.; control, 24.1 lb.

On 9th February last the Farmers' Union held a field-day at the area to give all those interested an opportunity of viewing the results of the experiment. On the top-dressed plots, especially Nos. 1 and 2, the alsike, white clover, suckling-clover, cocksfoot, and crested dogtail had taken a new lease of life. The clovers especially were very vigorous, and their growth was in marked contrast to the condition of the clovers on the adjoining control plots.

—R. McGillivray, Instructor in Agriculture, Invercargill.

WOOL-GROWING IN NEW ZEALAND.

SOME PRACTICAL POINTS FOR SHEEP-FARMERS.

Paper read by WILLIAM PERRY, "Penrose," Masterton, at the Annual Conference of the Royal Agricultural Society of New Zealand, Wellington, May, 1926.

THE sheep-stock of New Zealand have gone through many and various changes. In the early years of colonization wool-production was almost the only consideration, and the Merino and the Merino-cross sheep were the predominant breeds. But with the advent of the frozen-meat trade the longwool breeds began to find favour and took the place of the Merino, and now with the wonderful expansion of the fat-lamb trade a change has come over the whole sheep-raising industry. The proportion of longwool breeds has greatly increased, and consequently brought about a corresponding increase in the stronger wools of the Dominion.

There are three breeds of sheep which are coming very much into prominence—namely, Romney Marsh, Corriedale, and Southdown.

The New Zealand Romney has become somewhat different from its English cousin. It is a smaller and more compact sheep, and its wool has more lustre. A large amount of our Romney wool can be styled a lustre wool, whereas the Romney Marsh of Kent is supposed to grow demi-lustre wool. The best type of New Zealand Romney wool has lustre, length of staple, and is soft to handle; the average count is about 46's. Sheep carrying wool of this nature throw off the rain very effectively, carry a full fleece under adverse conditions, and shear a remarkable weight of wool. Some wool experts seem to think that the Romney should be made to grow wool of a 50's count. This could be done, but it would not prove a commercial proposition, as Romneys with a very fine fleece have a tendency to cast the wool on the points and produce a very light clip. The main faults breeders of Romneys have to contend against are kemps, dual fibres (hair and wool), harsh wool (semi-hair), and hairy breech-wool.

The Corriedale breeders have done great work in producing a valuable breed of sheep, more especially suited to a dry climate. The average wool count is about 50's. The best specimens of the breed have a very-high-quality wool. Breeders of the Corriedale have some of the same faults to combat as the Romney breeders, but in a lesser degree.

The Southdown is bred for mutton almost exclusively, but the wool is valuable for some purposes. Although Southdown wool is more crisp, the best fleeces show the same characteristics as the best longwools.

With the Romney, Corriedale, and Southdown it is desirable to have a solid, fairly square lock or staple, with the curl carried from the tip right to the skin. The lock itself should hold together, but the best wools are very free from cross-fibres between the locks. Wool of this nature will comb without much waste, or "noils" as they are called in the trade. Wool on the sheep (provided the animal is in fair condition) should open cleanly, and have a nice soft yolk carried right to the tip of the wool, with a soft pliant feel to the hand. Good

wool, whether it be of high or low count, should be bright in appearance (not a dead metallic white), with more lustre as the count goes lower. The yolk should be thin and about the colour of olive-oil. Heavy, yellow yolk generally goes with a poor class of wool. Sheep with thin or small staples or locks may have very good wool, but unless it is dense the back wool will not stand much rain, and will become weak and wasty. Sheep with thin locks will not stand a cold, damp climate.

Many breeders try to produce sheep with a very short curl in the wool, but this can be easily overdone. The length of the curl should be governed by the count or fineness of the fibre. For instance, a 46's Romney wool should have from five to seven curls to the inch, and a 36's about three to four to the inch. The best wools have a very gradual turn in the curl, and the curl should run longitudinally and not across the lock. Some brittle, harsh-handling wools have a short curl, but it is abrupt and runs across the lock, and on examination generally proves to be semi-hair.

The following extract from Bowman's book on wool-fibre may be here usefully quoted: "The wool-fibre has its growth from the skin of the animal, the root or starting-point being like a bulb. The blood-vessels of the body feed this bulb-like vessel with plastic lymph, which is changed by nature into nucleated cells. Nature further pushes this substance through the skin to the surface. This operation seems to change the outer or surface cells into flat scales, which form the outer wall of the fibre, the remainder of the cells forming the centre of the fibre. These cells form a loose mass, which allows the yolk or suint to flow through the centre of the fibre. The yolk seen on wool is quite separate from ordinary sweat. It is formed in a separate gland and fed into the wool-fibre before the latter comes through the skin. It then percolates through the centre of the fibre, a portion coming out through the open end of the scales on to the surface of the wool to nourish it."

The principal difference between a hair and a true wool-fibre is that the hair has a central core or medulla, which when seen through a microscope looks like a black strip. The scale formation is also different; the scales on hair are fastened very closely down, probably for two-thirds of their length, whereas the scale on wool is much more free. The woolgrowers' work is to eliminate all fibres showing a black centre, which are hairs, or those which show black disconnected streaks, termed semi-hairs.

There are several forms of hair to be found on sheep. Kemps are a short hair mostly found on the thigh and over the hips of a sheep, but sometimes all over the body. The hairs which cause the most trouble are those which are the same length as the wool-fibre, and sometimes appear longer. They are a metallic-white colour, always nearly straight, and will not take dye. Many sheep have hairy breech-wool—that is, wool and hair. This trouble can be bred out of any breed of sheep; it is just a matter of selection and care. The hair on the face, legs, or ears of a longwool sheep is a good guide to the nature of the animal. If it is hard to the feel, dirty-white in colour, and of a coarse appearance, then one can expect a second-rate fleece. On the other hand, if the poll shows no hair, and the hair on face, ears, and

legs shows good quality, with a bright, smooth appearance, one can expect the fleece to open up well. Mr. A. H. Cockayne (Department of Agriculture) has found by investigation that the harsh hairs are more or less flat, and the smooth, bright hairs are more of a rounded shape.

The nature and quality of the wool-fibre largely depend on the formation of the scales, and it seems possible by selection to breed great variations in scale formation. The scales govern the amount of yolk which comes from the centre of the fibre, the elasticity, and also to a certain extent the particular kind of curl. A short, open scale allows the yolk to flow out too freely, and therefore a sheep has to be in high condition before the yolk reaches the tip of the wool. Under ordinary conditions the tip will be dry and hairy. A short, open, pointed, scaled fibre is rough to the touch when rubbed between the finger and thumb, it does not stretch much, and will break off short when tested between the two hands.

Some wools have a pointed scale with a hook-like tip. These are very undesirable, and are the cause of most of the cotted or matted fleeces. This kind of wool, though it may be all right when shorn, will cling together afterwards. Good, soft-handling wool has a scale of medium length, smoothly fitted and suited to the size of the fibre, and apparently running round it instead of being narrow and pointed. This formation seems to regulate the flow of the yolk, so that it lubricates the fibre from base to tip. Wool of this nature handles softly, is lustrous, and very elastic.

The amount of curl in wool is not always a sign of quality. It is possible to get a poor-quality wool with a short curl; the open scales allow the fibre to turn abruptly, whereas a medium length scale will allow the fibre to turn only gradually.

The appearance of wool can be altered in a very short time by a change on to a different kind of soil. Both the curl and the yolk will alter, and in some instances this can be noticed in less than a month. A fairly rich, dry, clay loam will probably grow the most attractive wool. River-silt soils, and those formed from pulverized rock, will also grow a bright soft-handling wool, but not the same bulk as the clay loam. Rich papa country will grow a fleece of good weighty wool. Light soils of almost any description have a tendency to grow finer and lighter fleeces. Strong heavy clay land has the opposite effect. It will grow a strong wool with very little crimp and a lack of character. Limestone land, where the mineral is prominent, grows strong wool, hard to the feel, and with more of a twist than a curl.

Under ordinary conditions in the winter there is very little yolk flowing through the wool-fibre, and the fleece is apt to appear thin and fine. But when the spring sets in the fibre seems to swell and get much stronger and more solid. This effect is more noticeable on good land.

Rabbit Nuisance Act.—At its last meeting the Board of Agriculture decided to recommend that the Rabbit Nuisance Act be again consolidated, and approved of the proposals for the amendment of certain provisions of the Act relating to the establishment and working of Boards under Part III, which relates to the establishment of Rabbit Boards in reduced areas.

TOP-DRESSING OF HILL-COUNTRY GRASSLAND.

TRIALS IN WELLINGTON AND SOUTHERN HAWKE'S BAY DISTRICTS, 1925-26.

W. J. McCULLOCH, Instructor in Agriculture, Palmerston North.

FOR some years past it has been clearly apparent to sheep-farmers in certain parts of the North Island that the carrying-capacity of the hill country is declining, and it is safe to estimate on a conservative basis that the decline in many cases is equivalent to a third less stock than formerly. In these instances the decrease is not a result of secondary growth or bad management in stocking, but more strictly a matter of depletion of fertility, and the consequent succession or replacement of the previously sown English grasses by inferior or low-feeding-quality pasture-plants. On the greater part of such country the dominant pasture species to-day is either *Danthonia pilosa* or brown-top (*Agrostis tenuis*), with in some cases very sparse and stunted elements of rye-grass, cocksfoot, crested dogstail, white clover, and trefoil. In many instances careful search reveals only odd stunted roots of dogstail, with a very small proportion of suppressed white clover or trefoil, existing as remnants of a once vigorous and high-class pasture.

Investigation indicates that deterioration is chiefly confined to areas originally occupied by rain forest; so far, no significant decrease has been noted on other types of hill country in districts covered by this report. It is even suggested that, if anything, the reverse has been the case in connection with the non-forest areas, probably due to the unconscious and slow introduction of better-type pasture-plants through the agency of stock, &c.

The problem presented by a reduced carrying-capacity on the better-class hill country is certainly agitating the minds of settlers to-day and calls for immediate attention. Not only has production suffered during recent years, but it should be realized that it continues to decline. The breeder is conscious of greater difficulties in retaining sufficient bone in the flock, although his energies in this direction are greater than hitherto. Moreover, the percentages of fat lambs taken off the ewes have very markedly diminished. Although the gross revenue from meat and wool may have been greater in recent seasons of high prices there can be no doubt that the actual yields have lessened.

In the earlier stage of settlement the ashes and humus of the burnt forest provided sufficient fertility for a fairly lengthy period, but as, generally speaking, there has been no addition of fertility since, the ultimate result—inferior pastures—has inevitably followed.

Having regard to the foregoing main facts, an endeavour has been made by the Department of Agriculture during the past year (1925-26) to investigate the economy of top-dressing selected areas of hill country by hand. A total of twenty blocks of hill country over a wide range of varying types of pasture, typifying different degrees of deterioration, was selected. Under agreement the landholders were required to keep actual stocking records, also cost of application of fertilizers, &c.

Unfortunately, owing to the abnormally dry season in several districts and the consequent shortage of both grass and water, the stocking of some of the blocks could not be separated from the rest of the farm, and in such cases no definite data could be obtained. A number of the farmers, however, have supplied definite returns, while all are emphatic regarding the improved condition of the stock, and in most cases have volunteered the information that they intend treating further areas this coming season on their own account.

The first item of cost was transport from railway to farm. While some farms were close, and cartage as low as 3s. 9d. per ton, the cost for others at greater distance was as high as £2 2s. 6d. per ton. The average cost of cartage in twenty cases from railway to farm was 15s. 7d. per ton. In nearly every case the charges were for one-way freight, and it is admitted that these costs could have been lessened considerably if back-loading had been done in the wool season or other opportune time. The average cost of haulage from farm-steading to hill pasture was 15s. per ton; allowing wages at 14s. per day per man and 6s. for each horse, the average cost of applying (3 cwt. per acre) was 2s. 4d. per acre. The average area treated per man per day was 6 acres. The average total cost of top-dressing, including fertilizer at £7 per ton, handling charges, and application at 3 cwt. per acre, was £1 7s. 11d. per acre.

It will be noticed that in most of the experiments the fertilizer used was superphosphate alone; in the other cases Ephos phosphate was used alone.

All the farmers co-operating in the experiments have been asked to keep records of stocking during the present winter.

Following is a summary of individual areas treated where stocking records are available:—

JAMES ELLINGHAM, ORMONDVILLE.

The records of this experiment were very carefully taken. Two blocks adjoining each other, quite similar in pasture composition, aspect, &c., were compared, one being top-dressed with 2½ cwt. super per acre, while the other remained as a control (no manure). The fertilizer was applied on 6th July, 1925. Stocking records are from 13th July, 1925, to 14th January, 1926, for both blocks.

Breeding-ewes were carried on both blocks. The top-dressed block carried 1½ ewes per acre for the period, with lambs at foot, and ⅓ cattle-beast per acre. The control block during the same period carried 1¼ ewes with lambs at foot and ⅓ cattle-beast per acre. The manured block showed an increase of 21 per cent. of fat lambs off ewes compared with the control. The wool-clip showed no significant increase. The composition of the pasture is rye-grass, cocksfoot, and dogstail, with a large proportion of *Danthonia pilosa* and some brown-top.

The cost of transport of manure from rail to farm was 12s. per ton; sledging on to ground, 1s. 1d. per cwt.; and distributing by hand, 7 acres per day per man, 2s. per acre. The cost of applying 2½ cwt. per acre by hand, including all handling from rail, was 6s. 2½d. per acre. Allowing superphosphate at £7 per ton, the total cost of the top-dressing was £1 3s. 8½d per acre.

A. TOMLINSON, RONGOMAI, EKETAHUNA.

The area of this block is 40 acres, and it was top-dressed with 3 cwt. of super per acre towards the end of June, 1925. The stocking of the area was with breeding-ewes. During the period 4th July, 1925, to 18th March, 1926, the carrying-capacity was $2\frac{1}{2}$ ewes with lambs at foot. (No records of fat lambs produced.) The normal carrying-capacity is estimated at $1\frac{1}{2}$ ewes per acre. The composition of this pasture is mainly brown-top and *Danthonia pilosa*. The cost of transport of manure from rail to farm was 15s. per ton; sledging and packing, 1s. per cwt.; and distributing by hand, 10 acres per day per man, 1s. 5d. per acre. The cost of application of 3 cwt. per acre, including all handling from rail, was 6s. 8d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 7s. 8d. per acre.

A. K. GRIEVES, AOKAUTERE, KAIRANGA.

This block of 63 acres was top-dressed with 3 cwt. super per acre about the middle of September, 1925. A control block was used for comparison. During the period 8th November, 1925, to 31st March, 1926, the top-dressed block carried $2\frac{3}{4}$ ewes with lambs at foot and $\frac{1}{6}$ cattle-beast per acre.

In the same period the control carried 1 ewe with lamb and $\frac{1}{3}$ cattle-beast per acre. In the previous season the top-dressed block produced only thirty-seven fat lambs off the ewes; after top-dressing this season 120 fat lambs were taken off the ewes. The composition of this pasture shows considerable elements of rye-grass, cocksfoot, dogstail, and white clover, with some brown-top and *danthonia*, the whole in suitable condition to give good response.

Cost of transport of manure from rail to farm was 10s. per ton; sledging, &c., to hill, 2s. 4d. per cwt.; distributing by hand, 6 acres per day per man, 2s. 7d. per acre. The cost of application of 3 cwt. per acre, including all handling from rail, was 11s. 1d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 12s. 1d. per acre.

C. C. HIGGINSON, WAIKANAE.

This experiment has been carefully recorded, and also the carrying-capacity of the block since 1921, together with that of an adjoining block during the period under review. Mr. Higginson supplies the following notes: "In the summer of 1924-25, after top-dressing, the feed did not come away well and the results appeared to be disappointing. I therefore fed the paddock off in January, 1925, with cattle, and cleaned everything up and kept it empty of sheep from 15th December, 1924, to 1st April, 1925. The rain in February, 1925, caused a wonderful growth, and on 1st April I began with sheep again, putting on eighty-four low-conditioned breeding-ewes. These were the backward ewes from the breeding-flock. They built up during winter and had 100 per cent. of good lambs, but these were not quite so good as the lambs off the ewes in the adjoining block (not top-dressed), that was carrying at the rate of $1\frac{1}{2}$ ewes per acre with 95 per cent. of lambs. Two rams were running with the ewes on the top-dressed block from 1st April to 20th May. The stocking was with breeding-ewes mostly, with wethers, hoggets, and cattle at certain separate

periods, and the total period is taken from 1st September, 1924, to 8th May, 1925, for both sheep and cattle. Lambs running with ewes are not counted in the carrying-capacity. The top-dressed block carried $2\frac{1}{8}$ sheep and $\frac{1}{8}$ cattle-beast per acre for the total period, whereas the control block (not top-dressed) carried $1\frac{1}{2}$ sheep. The pasture is composed of *Danthonia pilosa* and brown-top, with a very little white clover, trefoil, *Poa pratensis*, and some cocksfoot. The country is very steep, and in this instance the manure had to be packed on to the ground. Super, at 180 lb. per acre, was applied in September, 1924. It is considered that the amount applied per acre was too small, and that up to 3 cwt. would possibly have shown better paying results, as cost of handling would not have been very much greater.

"The cost of cartage of manure from rail to farm was 6s. 3d. per ton; packing to hill, 2s. 1d. per 180 lb.; distributing, $5\frac{1}{8}$ acres per day per man, 2s. $7\frac{1}{2}$ d. per acre. Cost of application of 180 lb. per acre, which includes all handling from rail, was 5s. $2\frac{1}{2}$ d. per acre, allowing 14s. per man per day and 6s. per horse. Allowing super at £7 per ton, the total cost of the top-dressing was 16s. $8\frac{1}{2}$ d. per acre."

W. MACKAY, APITI.

This block of 45 acres was top-dressed with 3 cwt. super per acre early in July, 1925. Breeding-ewes were carried. Mr. Mackay states: "The ewes had to be shifted off on 1st December owing to bid-a-bid, otherwise there was plenty of grass. From these ewes I sold 60 per cent. of fat lambs off their mothers at 36 lb. average weight. The average of the country here will only do from 1 to $1\frac{1}{4}$ ewes per acre on grass, but I am convinced from my experience up to the present that I would sooner run 2 ewes to the acre where top-dressed than $1\frac{1}{4}$ where not top-dressed. I feel sure one will not overestimate the value of top-dressing by putting it down at one ewe more to the acre for six months autumn and winter, and two ewes more for spring and summer, or an average of $1\frac{1}{2}$ ewes more per acre for the year."

The opinion arrived at by this landholder is borne out in the actual records of stocking. For the period 1st August to 31st March the carrying-capacity of the top-dressed block is 3 ewes per acre. In the same period the control carried $1\frac{3}{8}$ sheep per acre. The composition of the pasture is *danthonia*, brown-top, Yorkshire fog, and catsear, with a little cocksfoot, trefoil, and white clover, and in places a little dogstail.

Cost of transport of manure from rail to farm was £1 per ton, to hill 5s. 8d. per ton, and distribution per acre 2s. Cost of handling, at 3 cwt. per acre, was 5s. 10d. per acre. Total cost of top-dressing, allowing super at £7 per ton, was £1 6s. 10d. per acre.

GEORGE PORT, MOUNT RICHARDS ROAD, POHANGINA.

A block of 40 acres was top-dressed. In this case it is clearly shown by the records that every advantage was taken to utilize the experimental block as a fattening-paddock for both sheep and cattle, and Mr. Port contends that, apart from the fact that the block carried easily twice as much as any of the adjoining similar areas, it paid handsomely as a topping-off paddock. From the ewes carried

between 1st September and 18th December 72 per cent. of the lambs were sold fat off their mothers. This was followed by a further draft of ewes and lambs, and again a further percentage of lambs was turned off to the buyer. On 5th October twelve forward cows were put on and sold fat on 11th January. On 11th January a further eight cows were put on to top off and were sold fat on 11th February,

Super was applied at 3 cwt. per acre on 17th June. The composition of this hill pasture was still good, showing a fair amount of rye-grass, cocksfoot, and white clover, also considerable dogstail, with brown-top in damper portions and danthonia on the warmer spots. Compared with the adjoining block, it looked decidedly more vigorous even from a distance.

The owner states in the course of his remarks: "I am so pleased with the results that I have now top-dressed the adjoining blocks, and have spent £200 on manure for this purpose."

According to the records kept, the carrying-capacity of this block (between 24th August, 1925, and 26th April, 1926) was $2\frac{3}{4}$ sheep and $\frac{1}{4}$ cattle-beast per acre. It is considered that the carrying-capacity was double that of the adjoining block. Cost of transport of manure from rail to farm was £1 5s. per ton; sledging to hill, &c., 10s. 8d. per ton; distributing by hand, $4\frac{1}{2}$ acres per day per man, 3s. 1 $\frac{1}{4}$ d. per acre. Cost of application, at 3 cwt. per acre, including all handling from rail, was 5s. 11d. per acre. Allowing super at £7 per ton, the total cost of the top-dressing was £1 6s. 11d. per acre.

FRANK W. PARRY, MOUNT BRUCE, MASTERTON.

In this case the appearance of the area indicated a badly deteriorated pasture, composed almost entirely of stunted, harsh brown-top with a little danthonia. No clover or trefoil was showing, but there was a fair amount of *Nertera depressa* weed, which always indicates lack of vigour and a poor sward. Recent examination showed clover and trefoil beginning to appear.

From the records kept the carrying-capacity for the period 15th July, 1925, to 30th April, 1926, was $2\frac{1}{4}$ sheep per acre, while the adjoining areas are reckoned as $1\frac{1}{2}$ sheep-country. Super was applied at 3 cwt. per acre early in July, 1925. Cost of transport from rail to farm was £1 per ton; from farm to hill, 5s. 10d. per ton; distribution by hand, $4\frac{1}{2}$ acres per day per man, 3s. 1d. per acre. Cost of handling, including distribution, was 6s. 11 $\frac{1}{2}$ d. per acre. Total cost of top-dressing, including super at £7 per ton, was £1 7s. 11 $\frac{1}{2}$ d. per acre.

THOMAS DUNN, IHURAU, MAURICEVILLE.

The area of this block is 50 acres, and the composition of the sward mainly brown-top and danthonia. Breeding-ewes were carried during winter and lambed on the block. During part of January, owing to drought and shortage of water, the gates had to be opened into another block, which interfered with stocking records for a short time. From the records taken the carrying-capacity works out at $2\frac{1}{2}$ sheep per acre between 1st August and 6th April, while the adjoining block, not top-dressed, carried $1\frac{2}{3}$ sheep per acre for the same period. Super was applied at 3 cwt. per acre early in July, 1925.

Cost of transport of manure from rail to farm was £1 per ton; farm to hill, 13s. 10d. per ton; distributing by hand, 5 acres per day per man, 2s. 9½d. per acre. Cost of application, 3 cwt. per acre, including all handling from rail, was 7s. 10½d. per acre. Allowing super at £7 per ton, the total cost of top-dressing was £1 8s. 10½d. per acre.

II. DENTON, LEVIN.

This block of 51 acres indicated a worn-out hill-country pasture, badly infested with *Nectera depressa*. The sward was composed mainly of danthonia, with brown-top in places. Although the season under review was not favourable, the owner states that this was the first time for years that lambs on this hill had fattened on their mothers. He is further of opinion that the clover has certainly increased as a result of the top-dressing, although the paddock as a whole has not shown the amount of improvement hoped for, owing, no doubt, to the unfavourable season.

Super was applied at the rate of 3 cwt. per acre in the early part of July, 1925. Records of carrying-capacity between 1st August, 1925, and 31st March, 1926, work out at 1¼ sheep and ⅓ cattle-beast per acre. The carrying-capacity on the adjoining country, not top-dressed, was 1¼ sheep and ⅓ cattle-beast per acre.

Cost of transport of manure from rail to farm was 5s. 9d. per ton; farm to hill, 13s. 10½d. per ton; distributing by hand, 6 acres per day per man, 2s. 4d. per acre. Cost of application, 3 cwt. per acre, including all handling from rail, was 5s. 3¼d. per acre. Allowing super at £7 per ton, the total cost of top-dressing was £1 6s. 3¼d. per acre.

F. S. FRANKLIN, MANGATUNA, DANNEVIRKE.

This block contained some 60 acres, and was top-dressed with 3 cwt. of Ephos phosphate per acre about the end of May, 1925. Writing on 10th April, 1926, Mr. Franklin states: "As you are aware, the season has been very dry for the last six months, and the fertilizer has not had much of a chance. Following are the details of stocking up to 10th January, at which date the water gave out, and we had to give the stock the run of the adjoining paddock. The usual carrying-capacity of this block before top-dressing was 98 ewes." According to the records given, the carrying-capacity after top-dressing, even in the past abnormal season, was the same: and on 3rd January a draft of fat lambs off their mothers, with an average weight of 32½ lb., was sold. The owner further states: "This was the biggest percentage we got away out of any paddock this year, and if the season had been normal this paddock would easily have carried another twenty-five to thirty ewes."

This owner had top-dressed a fairly large area of hill country in the previous year, and is again treating more country this season. The pasture is mainly danthonia and brown-top, with very scattered plants of cocksfoot and dogstail, a little white clover in places, and trefoil.

In this case cost of transport of manure from rail to farm was £1 15s. per ton; from farm to hill, 4s. 2d. per ton (sledding, &c.). Cost of handling from rail, including distribution by hand, 7½ acres per day per man, was 7s. 8d. per acre. Total cost of top-dressing, including Ephos phosphate at £6 10s. per ton, was £1 6s. 2d. per acre.

GEORGE BUCHANAN, WAITAHORA, DANNEVIRKE.

This block of 40 acres is purely brown-top, and was not by any means a palatable pasture, being a coarse, harsh growth with no sign of clover or trefoil. It was top-dressed during the last week in August, 1925, with 3 cwt. super per acre. Mr. Buchanan states: "As you know, the spring here last year was not favourable, so that, after feeding the paddock out with cattle from 1st September till 15th November, I only stocked it lightly with ewes during August and early September."

From 15th September, 1925, till 18th April, 1926, the stocking records work out at four breeding-ewes with lambs at foot per acre, and during the whole period $\frac{1}{2}$ cattle-beast per acre. Unfortunately, no definite comparison can be made, as details of the previous carrying-capacity of this block (likewise other adjoining blocks) are not full enough this season, no actual dates of shifting being available. As a comparison the owner states: "The adjoining paddocks carry about $1\frac{3}{4}$ breeding-ewes to the acre through the winter and until docking-time, when the dry ewes are taken out of them. Previous to top-dressing the paddock usually wintered from seventy to eighty ewes; these were lambd on it, and the dry ewes taken out at docking-time, generally about 20th September, or perhaps a week later."

In this case transport of manure from rail cost £1 per ton; sledging to hill, 17s. 4d. per ton. Cost of handling from rail, including distribution by hand at 4 acres per day per man, was 9s. 1d. per acre. Allowing super at £7 per ton, the total cost of top-dressing per acre was £1 10s. 1d.

G. H. HADFIELD, PARAPARAUMU.

The area treated in this case was 65 acres, which was top-dressed with $2\frac{1}{2}$ cwt. of Ephos phosphate per acre about the middle of July, 1925. The pasture composition was principally danthonia, mixed in places with brown-top. On a small area of one face rye-grass, cocks-foot, &c., were showing. Bracken fern had been troublesome on some of the steeper faces, but had been well worked with cattle some time previously.

The actual stocking records since top-dressing show that the area carried between 25th July, 1925, and 18th March, 1926, at the rate of three breeding-ewes and $\frac{1}{3}$ cattle-beast per acre. Unfortunately, the previous stocking records for the block are not complete, and therefore a comparison is not possible for a corresponding period.

The cost of transport of manure from rail to farm was 13s. 6d. per ton; farm to hill, £1 1s. per ton. Cost of application, at $7\frac{3}{4}$ acres per day per man, including all handling, was 6s. $2\frac{3}{4}$ d. per acre. Allowing Ephos phosphate at £6 10s. per ton, the total cost of top-dressing was £1 2s. 6d. per acre.

MAX SPEEDY, NGAPAERURU, DANNEVIRKE.

This area of 80 acres was top-dressed with $2\frac{1}{2}$ cwt. of super per acre in July, 1925. The pasture is composed almost entirely of danthonia, with brown-top in the damper shady spots. Comparison is drawn between the previous year's stocking of 125 ewes on this block, which runs out at slightly about $1\frac{1}{2}$ breeding-ewes per acre, as against $2\frac{1}{4}$ breeding-ewes, after top-dressing, for the period 29th August,

1925, to 14th May, 1926, and the handicap of an unfavourable season. Mr. Speedy points out that he sold 17 per cent. of the lambs off their mothers, but adjoining paddocks did not produce any, and that although this has been a very dry season the top-dressed country kept longer green than the untreated pasture, and showed greater improvement when spelled. Cattle, at $\frac{1}{18}$ head per acre, were also carried during the same period. The cost of all handling of manure from rail and distribution of $2\frac{1}{2}$ cwt. per acre was 7s. 5d. per acre. Total cost of top-dressing, including super at £7 per ton, worked out at £1 4s. 11d. per acre.

CLIFFORD ADKIN, LEVIN.

According to the owner, this block had carried well over $1\frac{1}{2}$ sheep per acre until about three years ago, when the carrying-capacity decreased very fast, coming down to less than one sheep per acre; but since top-dressing it has been carrying three sheep per acre (hoggets and ewes mixed), also a small line of yearling heifers. The cost of handling of manure in this case works out at 4s. 8d. per acre, including transport from rail and application at the rate of 3 cwt. per acre. The total cost of top-dressing, allowing super at £7 per ton, was £1 5s. 8d. per acre.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

CAPER - SPURGE (*EUPHORBIA LATHYRUS*).

ESMOND ATKINSON, Biological Laboratory, Wellington.

CAPER-SPURGE has not been scheduled under the Noxious Weeds Act, and—speaking strictly from the farmer's point of view—is of no very great importance. It is not a weed of grassland or of cultivated crops, being found chiefly in the waste places that occur in gardens and along roadsides.

Though caper-spurge is now naturalized from one end of New Zealand to the other, it is of very local distribution, and there are large areas where it is not to be seen at all, or is perhaps only represented by an odd plant here and there. In Cheeseman's Manual it is stated to be found in the "North and South Islands: Waste places; in rich, warm soils; not common."

Caper-spurge has been included in this series because it possesses undoubted poisonous properties, and is often sent in for identification as a "suspected plant."*

DESCRIPTION.

Caper-spurge is a smooth annual or biennial herb, up to 4 ft. or so in height, and decidedly blue-green or glaucous in colour.

The stem is generally unbranched and erect below, and is there clothed with long narrow leaves 3 in. to 5 in. long, the lower ones being turned back (see illustrations). Above, it is umbellately branched—

* The writer would here like to express his thanks to Mr. T. H. Broom, of Ashburton, who kindly sent carefully packed specimens of the plant, from which the accompanying drawing was made.

that is, all the stalks spring from the same point. A piece of one of these stalks is illustrated, and shows the heart-shaped floral leaves or bracts. These are set opposite one another, and are very conspicuous through the complete difference of their shape from that of the stem-leaves below.



FIG. 1. CAPER-SPURGE.

Plant (divided for photographic purposes) showing characteristic branching and difference in shape of lower stem-leaves (right) and floral leaves (left).

(Photo by H. Drake.)

In each of these pairs of bracts what looks like a single flower is borne, but it is really a cluster of several male flowers and one female, the whole cluster being surrounded by a greenish cup called an involucre. No drawing has been made of these flowers, and they will not be further described, because their small size makes it impossible to correlate them satisfactorily with any description except with the help of a magnifying-glass.



FIG. 2. CAPER-SPURGE.

(a) Branch with capsules; (b) lower part of stem in outline—both natural size; (c) seeds, natural size and magnified.

[Drawing by E. H. Atkinson.]

The flower-cluster is soon followed by a very conspicuous, roundish seed-capsule $\frac{1}{2}$ in. or more in diameter, which, when it is ripe, splits into three valves, each valve being itself deeply divided longitudinally, so that the capsules have the appearance of being six-valved. The shape and size and the markings of the seeds are better indicated by the illustration (c, natural size and magnified) than by description.

POISONOUS PROPERTIES.

All parts of caper-spurge are full of a milky juice, which possesses very acrid properties and causes irritation and blisters wherever it touches the skin; but it is the seeds that are the most dangerous, as they contain a violently purgative oil. These seeds have long been used medicinally in many European countries—twelve to fifteen being the usual dose on the Continent—so that it is not rare to hear of cases of poisoning as the result of an overdose. The symptoms are given by the United States Farmers' Bulletin No. 86 as inflammation of the mouth and stomach, and intense diarrhoea and vomiting. If the dose is sufficient there will be nervous disorders, unconsciousness, general collapse, and death.

Cases of stock-poisoning are fortunately rare, as it is said that only young animals will touch the plant, and these only when it is in its earliest stages. Stock as a rule may be said to avoid caper-spurge. When, however, it is eaten the symptoms are similar to those described in the case of human beings.

POSITION AS A WEED.

It may be thought by some reading these notes that a plant so little likely to cause trouble in New Zealand is hardly worth including in this series. However, the probability of the attractive-looking capsules being eaten by small children—who are quite likely to come across the plant—seems to justify an illustrated account being given of it.

Little need be said about control methods—there is no systematic way of dealing with a weed of this type—but it would certainly be wise to make a general rule of pulling up every plant of caper-spurge that is seen.

CLASSIFICATION OF TALLOW FOR EXPORT TO BRITAIN.

In regulations gazetted last year by the British Ministry of Health it is provided that lard, dripping, edible tallow, and similar rendered fats must have a certificate attached to each container of same if it is desired to introduce this commodity into the United Kingdom as "edible." The certificate issued by the New Zealand Department of Agriculture is to the effect that the material is derived from carcasses free from disease, and prepared and packed with all necessary precautions for the prevention of danger to public health, &c. For this reason it is obvious that the Department cannot furnish a certificate to cover consignments of farm or butchers' tallow should such certificates be applied for, the certificate being reserved only for the best grades of tallow that are considered fit for human consumption. The shipping of other tallows is, of course, not prohibited, but they are consigned uncertificated.

Noxious Weeds Orders.—The Mackenzie County Council has declared St. John's wort *not* to be a noxious weed within that county.

A CASE OF LEG LESIONS IN RAM HOGGETS.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Veterinary Laboratory,
Wallaceville.

IN October of last year an interesting condition, which it seems desirable to place on record, was recorded in a flock of purebred Romney ram hoggets in the Wairarapa district.

The sheepowner first noticed that some of the animals showed a bleeding patch between the accessory claws of the hind legs, and as a number of the rams in a flock of 550 were affected he called in Mr. T. A. Blake, Government Veterinarian, Masterton. Mr. Blake, later, brought a ram alive by motor-car to this Laboratory for experimental work. In the majority of cases the two hind legs were affected, but several had the fore legs more or less acutely affected, and an odd animal the corners of the lips. The condition commenced as a small raised area of skin, which soon sloughed off, leaving a raw bleeding patch about the size of a threepenny piece. Some days later this had grown to the size of a half-crown, and was in some cases dry and scabby, but usually broken and bleeding from the driving of the sheep for examination. Occasionally the lesions had progressed down to the heels and round the coronets, but this was unusual. Each sore was a surface condition, and did not produce lameness in any one case—in fact, the rams fed well and lost no condition, being large forward animals. At the Laboratory a lesion was easily dissected off under a local anæsthetic, leaving smooth, healthy subcutaneous tissue which quickly healed over. The time between a sheep becoming affected and the natural healing-up of the lesions was in the vicinity of from three to four weeks. Only ram hoggets were affected.

The country upon which the sheep were running was excellent old-standing sheep land. Much of the area was flat and very well watered, bordering a lake. The remainder was hill country, where there was plenty of good grass. It will be realized that the weather during the winter had been exceedingly wet, and feed was growing in abundance, but was still soft. The rams had been running on turnips for a fortnight in August, and had then been distributed in small lots over a number of paddocks to get full benefit of the excellent pasture. Once the trouble was noticed a number were placed on the hill country, but these also became affected.

The ram brought to the Laboratory gave material for experimental work, and sections from the lesions, the organisms present, and the development of the lesions were all carefully examined. By scarifying the surface of the skin of the pastern or of the thigh, and introducing a small amount of the infected material from the affected ram, one was able to show that the organisms present would cause similar lesions on rams, lambs, wethers, or ewes, anywhere on the skin, but that before the lesion developed there had to be some injury to allow the entrance of the infective organism. This was considered to be *Bacillus necrophorus*, an inhabitant of many soils where animals have been pasturing for any length of time. In December, as two lots of rams which had not previously been noticed affected were commencing to show lesions, it was decided to thoroughly examine the state of the run, the condition

appearing to be of the nature of a contagious disease. Mr. Blake and the writer spent some time going over the run and the infected animals.

The following possibilities presented themselves :—

(1.) Result of feeding on turnips : As it was some time after coming off turnips that the sheep were noticed to be affected, and although they were together for the last time on these roots, it did not seem possible to implicate turnip-feeding.

(2.) Thistles : There were a few thistles with the turnips, but, as ewes were also run on the same land and were not affected, one could not blame thistles for causing the original injury whereby the necrosis bacillus gained entrance.

(3.) Ergot : This was not present to any extent on seeding heads of the grasses, nor did the lesions resemble known ergot lesions in cattle.

(4.) Bruising of posterior surface of fetlock on rough paddocks made boggy by cattle and later hardened by the sun : The paddocks were in splendid order and had few cattle running on them, thus ruling out bruising.

(5.) Inbreeding and lack of stamina : This was not a factor, because of the constant new blood brought into the flock.

As none of these possibilities could be considered causative a thorough examination of two paddocks of rams was undertaken, each animal being caught and thoroughly examined for fore-leg, mouth, and hind-leg lesions. While examining the mouths it grew more and more noticeable that only rams with their two teeth erupting were showing lesions. Where teeth had come through early no lesions had developed nor healed, and where teeth were commencing to erupt the lesions were only commencing. This fact became so striking that one could tell from the teeth what to expect on the legs.

The explanation of the whole trouble appears to be as follows : The pasturage had been so soft throughout the earlier part of the season, when the rams should have been teething, that no help had been given the teething process. Teething was therefore exceptionally late in the whole flock, and to a large extent throughout the locality. Ewes on rougher feed had commenced teething somewhat earlier. The rams were in forward condition, and had been so well flushed that they undoubtedly had a mild fatty infiltration of the liver, which would prevent that organ dealing thoroughly with poisons developed as a result of teething. Further, the kidneys of young sheep fed excessively often fail to act in eliminating these poisonous materials of the blood (the extreme condition being pulpy kidney of lambs), so that the skin is called upon to act in place of the kidneys. A rash will then develop. As supporting this theory it was noticed that many of the rams had a pustular rash over the scrotum and down the thighs where it could be noticed, and even beneath the hair of the legs when these were carefully examined. A rash indicated an injured skin-surface where the necrosis bacillus could attack. The country having run sheep for many years, necrosis bacilli were present everywhere and accepted the opportunity given them for attack. It therefore seems to be quite feasible that late teething had led to the appearance of the leg lesions in these rams.

IMPORTATION OF FERTILIZERS.

ANNUAL STATISTICS, 1925-26 AND 1924-25.

Chemistry Section.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1926, have been prepared as usual from figures specially supplied by the Comptroller of Customs, and are presented in the accompanying tables, together with similar data for the preceding year for comparative purposes.

TABLE I.—SUMMARY OF FERTILIZER IMPORTATIONS, 1925-26 AND 1924-25.

Fertilizer.	Quantity.		Declared Value.	
	Year 1925-26.	Year 1924-25.	Year 1925-26.	Year 1924-25.
	Tons.	Tons.	£	£
Bonedust	2,085	2,452	18,851	23,210
Bone-char	309	396	1,270	1,756
Basic slag	44,314	45,682	139,136	137,213
Superphosphate	500	10	1,856	29
Nauru and Ocean Islands phosphate	77,797	108,163	98,827	150,340
New Caledonia phosphate .. .	11,784		22,217	
Seychelles Islands phosphate .. .	7,907		12,055	
Egyptian basic phosphate .. .	10,037	8,530	32,363	25,313
Nitrogenous guano	20	..	236	..
Kainit	3,110	4,001	8,214	9,137
Muriate of potash	25	2	145	17
Sulphate of potash	1,356	1,126	13,728	11,574
Potash, other	4,238	2,287	16,749	8,321
Gypsum	1,402	354	2,220	574
Sulphate of ammonia	1,227	841	17,037	13,158
Nitrate of soda	1,284	816	16,033	9,751
Sulphate of iron	67	96	743	1,043
Fertilizers unspecified	..	12	247	1,371
Totals	167,462	174,768	401,927	392,807

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1916-26.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphates.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	..
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530
1926	2,085	44,314	500	97,488	10,037

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1926, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.		Chile.		India.	Pacific and Indian Oceans Islands.		United Kingdom.				Belgium.		France.		Germany.		Egypt.	Netherlands.
	Nitrogenous Manures.	Bonedust and Bone-char.	Gypsum.	Nitrate of Soda.	Bonedust.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Phosphate.		
Auckland	474	583	1,000	1,218	1,000	New Caledonia .. Seychelles .. Nauru .. Ocean ..	2,821 3,576 53,978 7,012	200	6,859	1,075	..	12,581	117	150	1,559	20	2,787	1,518	..
New Plymouth	20	..	..	..	..	New Caledonia .. Nauru .. New Caledonia ..	620 3,047 2,323	..	5,749	175	..	9,730	..	..	250	..	121	..	..
Wanganui	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	994	..
Napier	..	..	..	..	..	..	..	..	3,465	65	5	100	5	..	460	..	155	3,020	..
Wellington	40	..	..	25	25	..	..	..	300	20	..	55	..	..	30	..	125	..	..
Nelson	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton	320	..	..	..	..	Seychelles .. Nauru .. New Caledonia .. Ocean ..	1,690 5,071 1,223 4,104	..	5	70	..	60	..	..	335	..	20	1,500	..
Timaru	..	..	..	..	..	New Caledonia .. New Caledonia .. Nauru .. Ocean ..	779 2,710 2,840 1,455	..	..	25	..	..	..	..	..	..	..	..	..
Dunedin	65	..	402	..	..	..	690	..	200	10	..	70	..	..	280	..	75	904	..
Invercargill	83	186	..	10	..	Nauru .. New Caledonia .. Seychelles ..	2,148 1,386	1	425	25	..	1,200	..	..	395	..	405	2,101	500

NOTE.—For corresponding statistics for year 1924-25 see *Journal*, May, 1925.

WATER-HYACINTH IN NEW ZEALAND.

INFORMATION has been received that water-hyacinth (*Eichornia speciosa*)—which belongs to a small family of water-plants not in any way related to the true water-lilies—is being introduced into the Waikato district and there sold as an ornamental flower for growing in lakes and rivers. It has for many years been established on a small scale in several different parts of the North Island, and while in some cases but little trouble has arisen, in others great regret is expressed that it was ever planted.

Water-hyacinth is a plant of extreme beauty, and it is natural enough that those who possess suitable sheets of water and who have not heard of its evil reputation as a weed in other countries should look on it as a great acquisition. Before water-hyacinth is in any way encouraged or distributed about the country, however, it should be remembered by those concerned that it is a plant capable of growing on the surface of water, and, under favourable conditions, of quickly covering large areas to the extent of making them impassable even for steamers on large open streams. Immense sums have been spent in the warmer parts of North America and Australia in keeping waterways free from the weed. While it is quite true that many parts of New Zealand are too cold for the plant—which, it is reported, cannot stand frost—it should be emphasized that so little is known at present about its behaviour in this country in a wild state that the wisdom of taking all possible steps to prevent its further distribution must be obvious.

The matter is being taken up officially, and the Department of Agriculture will be glad to hear of any details, such as the presence of the water-hyacinth in any locality and its behaviour there. An illustrated descriptive article and report on its local distribution will appear in a later issue of the *Journal*.

IMPORTATION OF PRODUCE FROM THE UNITED STATES.

IN accordance with the promise made when the embargo was first imposed against the importation of agricultural produce from California, Washington, and Oregon, that due notice would be given of any proposed modification of the regulations, the Minister of Agriculture announces that, provided no fresh outbreak of foot-and-mouth disease occurs in the meantime, it is the Government's intention to modify the regulations as from 1st August, 1926, to permit of the introduction of the seeds of flowers, vegetables, grasses, clovers, and trees—(a) grown in States other than Texas and California, upon production of a certificate signed by the consignor indicating the State in which the seed was grown, and (b) grown in California or Texas, upon production of a certificate signed by the consignor to the effect that the seed is the produce of California or Texas, but was not harvested prior to 1st April, 1926.

Dehorning of Cattle.—This question was further considered by the Board of Agriculture at its last meeting. It was decided to report to the Minister that the time had arrived when a Bill should be brought in to make dehorning compulsory, except in the case of stud and pedigree cattle.

SEASONAL NOTES.

THE FARM.

LIMING.

LIMING of land—more especially in the form of pasture top-dressing—should be completed during July if its beneficial effect is to be shown in the ensuing spring. The result should be reflected in better pastures, in that one of the main effects of lime is the encouragement of desirable grasses and clovers and the depression of undesirable weeds. When lime is applied to arable land it should be broadcasted and worked into the soil in course of the final tillage.

On heavy, raw types of soil ground burnt lime can be advantageously used, a dressing of 10 cwt. to 15 cwt. per acre generally sufficing. On the lighter types of land finely ground carbonate of lime is to be recommended at 20 cwt. to 30 cwt. per acre. For general purposes 18 cwt. of carbonate of lime is equivalent in calcium to 10 cwt. of burnt lime. It will therefore be appreciated that where carting has to be carried out over long distances burnt lime is economical.

For low-lying, stiff subsoil land some system of under-drainage, followed by liming at the rate suggested, is a practice of much merit. The scheme could be conveniently worked if 15 to 20 per cent. of the farm area were limed each year. This would increase the area of the winter grazing considerably, and at a cost within reach of the average farmer.

Though more difficult to handle than carbonate, burnt lime, of course, gives quicker results. Especially is this the case on heavy land and land rich in humus and organic matter. The quicklime helps to free and open up the texture of the heavy land, and also has a warming effect on naturally cold soils. It also acts on the humus and organic matter in the soil and converts it into an available form of plant-food.

Where lime is applied as a top-dressing to grassland, farmers should bear in mind the necessity for following it up by an application of phosphate in the spring.

DRAINAGE.

Money spent on applying lime and fertilizers to badly drained country is money more or less wasted. Where land lies long in a sodden condition good under-drainage will show up to advantage, purely surface drainage not being sufficient. Under-drainage, where it is possible, removes the surplus moisture to the depth of the drainage-system, permits earlier cultivation, and ensures a reasonable absorption of heat in the early spring, hence earlier spring growth. Surface drainage removes only excess surface moisture and not the surplus of water already in the soil. If excess soil-moisture is not removed by under-drainage, then it remains in possession of what should be air-spaces, and must subsequently be removed by evaporation. This is a slow method and very wasteful of early spring heat,

hence the later growth and a longer hold-up of cultural operations. Moreover, increased aeration of the soil means greater activity of the nitrogen-fixing bacteria and consequent increase of plant-food.

Where the subsoil is firm and the fall of the land suitable mole draining is often the quickest and most economical method of bringing about better conditions in so far as excess moisture is concerned. In drain-ploughing it is necessary to make provision for the rapid get-away of water from the outfalls. In Southland mole drains are frequently drawn at about 10 ft. apart, but distance is governed by soil conditions and the draining-capacity.

PASTURES.

Harrowing of pastures should be completed during the coming month, likewise any proposed top-dressing, if results are to be expected early in the new season. Only quick-acting or fairly-quick-acting manures, such as super, basic super, or a mixture of lime and super, should now be applied for this purpose.

One or two top-dressed and harrowed paddocks should now be selected and shut up for early calving-cows and early lambing-ewes. There is nothing better for these animals than a nice clean pasture.

CULTURAL NOTES.

Where intended wheat crops have not been sown by about the middle of June it is as well to postpone the operation until August.

Ground in which it is intended to sow peas for commercial seed crops should be well prepared in July for August sowings. In Marlborough top-dressing of the ground in July has been shown to be better than applying manure with the peas when sown.

Clover stands to be saved for seed should receive a minimum of cultivation during the first year. In the second year an occasional stroke with light harrows prior to shutting up in August will in many cases prove beneficial. Superphosphate, at about 2 cwt. per acre, should be applied before the beginning of August.

Where no fresh young pasture can be made available for ewes and lambs, a sowing of 3 bushels oats with 5 lb. to 6 lb. mustard per acre will provide quickly grown early feed.

Catch-crops intended for green-manuring should be ploughed in during the coming month so that the material may decay before the sowing of spring crops.

MISCELLANEOUS.

When roots are badly affected with rot, it is advisable that they be fed out on some permanent-pasture field which will not be cropped for three or four years at least. This will minimize the danger of reinfection. Stock from diseased areas should not have access to fields which it is intended to crop. The same applies to pigs grazing over the farm. If they are wintering on diseased artichokes they should not have access to any proposed new artichoke area, otherwise infection will probably reappear.

Ensilage may with advantage be fed to yearling cattle, which often winter badly. A ration of 10 lb. to 15 lb. is considered sufficient.

Where gorse or broom has been allowed to spread on the farm many days not suitable for other work could be profitably occupied in grubbing it out. It is the well-kept farm that is sought after, and the work of clearing such weeds may be regarded as profitable as well as necessary.

—*Fields Division.*

THE ORCHARD.

PRUNING OF APPLE-TREES.

THERE are large numbers of apple-trees throughout the Dominion ranging in age from seven to fourteen years. Much has been written on the subject of pruning which is very helpful, but one meets with many instances where pruners of very little practical experience have followed too closely the theoretical rule laid down for the training of fruit-trees, but with no trees of mature age to guide them. Consequently production in many cases has been retarded, and in others trees have been ruined by overproduction before they were ready for the burden imposed on them. I would advise those who still have younger trees to study the older trees before putting the secateurs into operation on the former, as there are few of us who cannot learn something from the natural habit of the tree, and it is often from the cut that we did not intend to make that we learn the most.

The Jonathan.—Going back to the earlier days of the Jonathan I remember how it was mostly deprived of all side shoots right to the base, from which, unless exceptional vigour was maintained in the tree, no further shoots resulted; and to-day can be seen many evidences of bare foundations, with the bulk of the fruit borne higher up the branches, denoting the time when experience taught that the earlier method was not the one to follow. To-day we know that in order to keep the Jonathan a regular bearer we must produce new wood annually, and utilize it to provide new buds on two-year-old wood as well as on bearing-laterals. In the treatment of yearling wood we have also learned that to retain growth we must not depend on the first one or two half-developed buds for our wood-shoots, as on trees of moderate growth a dead stub will usually result. A plump bud must be left at the terminal if extension of growth is required from this source; and for the production of fruit two years hence a sufficient number of buds must be left, according to the strength of the wood-shoot, to ensure continuity of growth and provide room for fruiting-buds between these and the last year's cut. In the case of trees on which growth is diminishing, whether it be leaders or side shoots, one should not hesitate to cut back to a stronger shoot, as by doing so vigour will be imparted to the whole branch and probably save more drastic treatment in a year or two hence.

The Delicious.—What huge crops of this variety were conjured up in the minds of growers from those strong-growing straight-limbed young trees. Looking back at many of them to-day I recall how many pruners tried to subdue them into cropping by continuously severing all their annual growths off to the base, leaving only so many shoots as were considered necessary to form the framework, from which would again arise a multiplicity of shoots which could have been used

much earlier for fruit-production than in many instances they were, and with greater profit to the grower. In many instances the Delicious trees have actually been subdued into cropping by summer pruning, but I venture to think had a voice whispered "Oh, woodman, spare that tree" a few years earlier the result, regarding both tree and crop, would have been in the owner's favour.

In training the Delicious to-day I would say, Get your foundation and framework as soon as possible, according to the vigour of the tree; utilize the weaker growths for fruit-production as soon as they become available; and after the trees get up to the sixth year, if growth is still vigorous and the trees disinclined to set fruit, allow some of the well-spaced stronger growths to develop without pruning. It will then be found that fruit-buds will abound for the next year, and the girth of the shoots will be greater than if they had been pruned. The next season the cut should be made above the two-year-old wood, leaving several buds of the yearling wood for the continuation and subdivision of the branch, after which a little study of the particular shoots will decide the course of action to adopt. As with all other trees, however, this system of modified pruning can be overdone in the Delicious. I would warn pruners that such a method is only good for strong-growing trees, and if applied to weak-growing trees it only results in overburdened branches—all fruit and no wood-growth—which will have to be rectified sooner or later by drastic deletion to restore the vigour, without which the fruit produced will soon deteriorate both in size and quality.

WINTER SPRAYING.

The spraying of pip-fruit trees during winter against insect pests and fungous diseases is sometimes practised by orchardists. Personally I consider the winter the least favourable time to engage in this work, for the reason that materials such as oil sprays and lime-sulphur washes are the least efficient during cold weather, and require stronger dilutions to attain their object. Again, most fungous diseases from which pip-fruit trees suffer are quiescent during the colder months. Likewise the living insects are better secreted to withstand the cold, and their eggs are in a condition to withstand exposure to a greater degree than in the spring-time. From these considerations spraying is best delayed until the early spring, unless circumstances are such that the work cannot be delayed.

—J. H. Thorp, *Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Throughout this coldest part of the year citrus-trees will require protection against stagnant water in the soil, and, in the case of young trees, against frost damage. Every attention should therefore be given to surface drainage in order to remove surplus water, and light-scrim protection should be afforded to young trees in very exposed situations.

Shelter-belts may be trimmed and new shelter planted as required. Land should be prepared for new plantations. Lemons and Poorman oranges should be harvested as ready.

—W. H. Rice, *Orchard Instructor, Auckland.*

THE APIARY.

MOVING OF BEES.

At this season of the year bees may be moved to a new location with perfect safety. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees will be enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore, if the hives are moved during a spell of bad weather the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive-entrance. It is then only necessary to secure the bottom and roof, and, after making sure that there are no holes through which the bees can escape, the hive may be carried with safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and neglect of this matter leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. First see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as the hive-body, and covering this with wire cloth such as is used for making queen-cages. The screens must be securely fastened to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper will be well advised to adopt this method if it can be obtained. In any case the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

CONDITION OF HIVE MATS.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp, and should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. As far as possible do not disturb the colonies when making an examination, and especially avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed see that the smoker is handy in case the bees are troublesome, but do not use smoke unless the bees have to be driven down. Remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

LEAKY COVERS.

Damp mats usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this factor cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight will repay their owner many times over, and prevent to a large extent the loss of heat generated by the bees. One should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the unproductive season, and this will be impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

PERMANENT SHELTER.

Now that the actual work of the apiary is off the beekeeper's hands for a while he may devote his attention to the matter of providing permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any provision the beekeeper can make for their comfort. In addition to protecting the bees during the winter from stormy winds, it is an incentive to increased brood-rearing in the spring and early summer.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly, and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants shall stand cutting-back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, will provide ample shelter for a large apiary. There will also be less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the idea should be to form thick shelter and not a plantation.

—*E. A. Earp, Senior Apiary Instructor.*

POULTRY-KEEPING.

MATING THE BREEDING-BIRDS.

THE busiest season of the year and the most important one—that of hatching and rearing young stock—is now near at hand. Thus no time should be lost in getting the breeding-birds mated and the hatching operations under way.

It is always a good plan to have some July-hatched pullets, as these will lay during the autumn at the time when fresh eggs command high values. Such early-hatched stock will mostly moult before the winter season sets in. Nevertheless, if well fed and managed they will give a good return of eggs just when the adult stock are commencing to take their period of rest prior to moulting, and when the returns of the average poultry-keeper commence to decline. Of course, the main flock of pullets intended for winter laying should be brought out some time in August or September.

Those poultry-keepers who have acted in accordance with the advice given previously in the *Journal* will have selected and carefully marked the best breeding-specimens during the late autumn, or, in other words, before the birds moulted. The poultry-keeper who has failed to do this may expect a large percentage of culls and unprofitable stock. The time is opportune to reiterate the advice that too much care cannot be taken in making the final selection (even where the late moulters are concerned) so that no bird is placed in the breeding-pen unless it is healthy and conforms to the standard-weight clauses of its respective breed, lays at least a 2 oz. egg, and, above all, possesses undoubted constitutional vigour.

From now onward to the end of the breeding season the hens should be treated in a manner conducive to their being in the best condition to produce eggs containing good fertility and strong germs. This implies that they should not be forced for eggs by the oversupplying of animal or other forcing food. The plainer the ration the better will the results be, provided a variation of grain foods is supplied and an abundance of green material. Exercise is of special importance for hens that are producing eggs for reproductive purposes. It should be induced as much as possible by making the birds scratch for their grain food in deep litter. Without exercise the birds are liable to become overfat, a condition which is all against the production of vigorous progeny.

The sire is more than half the flock, and if he is to have the desired prepotency the power to transmit his inherent quality to his offspring—he must also be maintained in the best condition it is possible to have him in; not necessarily in an overfat condition, but full of life and vigour. The male should be frequently examined, and if it is found that he is becoming run down, or his health is impaired in any way, he should be immediately replaced by a reserve male. Some people depend on one male for the breeding-pen because of the cost of keeping a second bird. This is a mistake. It is much sounder policy to cull a drone hen than a cockerel which would make a desirable reserve sire.

FARM POULTRY.

There are many farmers who still declare that fowls will do little more than pay for the food they eat. Unfortunately, this is very true of the majority of farm flocks in the Dominion. They eat too much for the eggs they lay. If all hens in farm flocks were bred from high-tested strains, and if they were properly housed, fed, and managed, and were rigidly culled at, say, the end of their second laying season, instead of being, as is too often the case, old-age pensioners, our farmers would soon discover that the food consumed by their fowls represented money well expended, and that their poultry were as profitable for the time spent on them as their other stock.

Some farmers base the profits to be made on the class of bird that was available about thirty years ago, when the breeding and management of useful poultry were little studied, and when the great bulk of the fowls were of the barnyard type. It is true that many farmers purchase good foundation stock, but too often these are bred from in a haphazard way. If the good qualities are to be maintained it is of the first importance that only the best specimens be selected year after year for the breeding-pen. The common weakness of using eggs for hatching purposes from the whole of the flock just because they *happen* to be there will soon lead to deterioration, however well the flock may have been bred in the past.

Just as the dairy-farmer endeavours to select his cows on the amount of butterfat they produce, so should the selection be made in the case of fowls according to the number of eggs they lay. The only safe course is to select a few of the best hens and place them in a pen by themselves. Such birds are easily detected by a little study and observation during the late autumn. It will usually be found at this period that the early moulters are the poor layers, and the late moulters the good layers.

It is a mistake for the farmer to keep too many breeds of poultry. One pure breed of fowls and ducks is the most that can be handled to the best advantage. There is no best breed of fowls for the farmer to keep. It is a matter of strain rather than breed that must be always considered. There is often more difference in strains of the same breed, so far as egg-production is concerned, than there is between different breeds. At the present time the White Leghorn is the most popular breed, but it cannot be regarded as an ideal farmer's fowl, chiefly because it is not to be depended upon for hatching and rearing purposes. The value of White Leghorns as egg-layers has been demonstrated by the competitions; but it must be remembered that some of the heavy breeds have done equally well. Taking the year's return for eggs and carcase combined, a good laying-strain of such a breed as the Black Orpington or White Plymouth Rock has several advantages over the light breeds. The chief advantage is that they can be depended upon to make good sitters and mothers, because usually the hatching and rearing of stock on the farm are done in a natural way.

Another bird that presents special advantages to the farmer is the Indian Runner duck. It is a great forager, and when a good range is available it will pick up for its living a considerable amount of material which would otherwise be wasted. Given a good laying-strain of this

breed, they will prove phenomenal egg-producers; in fact, there is nothing better from this standpoint. For table purposes, owing to their general lack of size, they are not favoured, especially for the high-class trade. If, however, a Pekin drake is mated to the Indian Runner females this union will produce an excellent table carcase.

The great weakness on most farms is that few eggs are produced except during the spring and summer months, when the hens lay naturally. If the most profit is to be made, sufficient pullets must be reared each season to replace a proportion of the adult stock. These must be hatched at the right season—say, from July to September—and then, by careful feeding and management, be induced to lay during the late autumn and winter months.

I would appeal to the farmer and his wife to encourage their children to interest themselves in the keeping of poultry. Among farmers' families there is usually a boy or a girl who could undertake the work and take an interest in poultry if given the encouragement and opportunity to do so. This can be best done by purchasing a pen of purebred fowls of a high-type laying-strain, and by providing up-to-date housing and runs. Then the young people should be encouraged to read and study the writings of up-to-date practical men, so that old-time methods of management may be discarded and the most modern ideas adopted. In this connection I would advise securing the Department's pamphlet "Utility-poultry Keeping," which is obtainable at 1s., postage paid, and contains practical advice on all branches connected with the industry. Further, should difficulties arise at any time which cannot be overcome, the advice of the Department's district Poultry Instructor (which service is available gratis) should be sought, in order that the trouble may be investigated and prevented during the early stages.

There are great possibilities for side-line poultry-keeping in the Dominion. On the local market there is no keener demand for any article of diet than for fresh eggs and high-quality table poultry. New Zealand eggs also possess a specially good name on the London market, to which any surplus supply can be exported at payable prices to the producer. The great aim of all poultry-producers should be to develop this trade. It is the farmer in particular who can do this, if he could but be induced to keep nothing but purebred tested stock and give them the same care and attention as his other classes of live-stock. It should be remembered that what is being done at egg-laying tests in high yields can be done at home, or even better.

—F. C. Brown, Chief Poultry Instructor.

HORTICULTURE.

CARE OF TOOLS AND IMPLEMENTS.

To speak of the care of implements on the farm is sometimes regarded as a counsel of perfection in these days, and one thinks of methodical people so immersed in detail that the main issues of business are overlooked. While such habits are fatal to the fullest success, those who allow tools to become muddled and rusty and knives blunt and dirty are in a worse plight, and, unfortunately, it is very much the

commoner one. The excuse always is that there is no time to attend to these matters, but one cannot help but feel there is also no desire. To employ a man and give him a blunt, dirty spade to work with is spoiling both the job and the man, with a consequent loss to the employer. If at the end of the day the spade is wiped clean and dry, and put in its allotted place in the shed, it becomes polished, and if sharpened with a file as required an employee will do better work and with more interest; so also with other machinery and implements. The present interval between seasons affords a suitable opportunity to overhaul the implement shed.

THE GARDEN DIARY.

Risking again the above impeachment, a plea is here made for the garden diary. A record kept—quite apart from the ordinary account-books—of the various operations carried out and their results is invaluable in a business of this kind that is of any size. The book might be spaced off under headings indicating fields or plots or glass-houses, and all details of operations, such as cultivation, manuring, seeding, spraying, harvesting, &c., entered up under the respective titles as they took place. As a frontispiece a plan of the property showing subdivisions and drains would be appropriate.

The value of such a record when planning for another season is obvious, as it enables a true rotation of cropping to be made and manuring recipes to be made out with the greatest chance of economy and effect, in addition to supplying valuable data enabling a correct judgment of the policy that has been adopted in the past. Expensive manures have now to be ordered and crop rotations decided. Right decisions on these points do not depend merely on the operations of the previous season, but of many.

VEGETABLE-GROWING.

Crops of peas, lettuce, cabbage, and cauliflower planted out in late autumn will commence to renew their growth now in the warmer localities. This will require advantage to be taken of the first opportunity in bright dry weather to hoe these crops. Later they may be assisted with a moderate dressing of nitrates. At such a time main-crop cauliflower and cabbage (green and red) and lettuce and onion plants sown in autumn may be planted out on well-prepared ground. A moderate dressing of superphosphate and potash applied just before this is done would be appropriate. For the onion crop the land must be well settled and rolled before planting.

In order to cater for the demand on the farm for the popular pickled onion, a bed of shallots planted now will assure those supplies with very little trouble. In a similar manner may garlic also be planted now. Its exceptional medicinal properties and its importance for flavouring dishes, when used with discretion, make this vegetable deserving of more consideration.

Tuber sets of that excellent member of the sunflower family, the Jerusalem artichoke, planted now about 6 in. deep and 2 ft. apart, will, with little further attention, yield an abundant crop of wholesome tubers for winter use. In localities not subject to late frosts a setting of early potatoes may be made, and in the drier districts where it is

the practice to sow the main onion crop in spring that work may be done as soon as the ground can be got into suitable condition. Spinach is a popular dish in spring and early summer. It also may be sown now to advantage, also lettuce.

The asparagus and rhubarb beds will soon require attention. Give them shallow cultivation, turning in a good dressing of organic manures—blood and bone-meal if others are not available.

Pricking out seedling tomato-plants into boxes and preparing the ground in the glasshouses where they are later to be planted out is seasonable work for this section. Avoid chilling the young plants by watering them with very cold water. It is a good plan to stand tins of water in the glasshouse some time before it is required, so that its temperature may be raised sufficiently.

THE SMALL-FRUITS SECTION.

Pruning in the small-fruits section is an operation demanding attention at the present moment. While tomatoes and vegetable crops are commonly very heavily manured, it is rather surprising that these heavy-bearing berry plants are so often in poor condition for want of manure. The present is a suitable time to give this attention, turning the manure in with a shallow ploughing.

If these operations are carried out in a liberal manner the natural vigour of the plants will go a long way in resisting most ordinary diseases. It is as well, however, to give most plantings at this season a good application—just as growth commences—of that bluestone spray known as Bordeaux mixture, using the formula 8-6-40 when mixing—that is, 8 lb. bluestone, 6 lb. lime, and 40 gallons water. The correct method of mixing this spray is important. Other methods of mixing the same ingredients give quite a different and inferior result. Departmental bulletins on these sprays may be obtained free of cost on application.

PLANTING OF TREES AND SHRUBS.

The planting of trees and shrubs should be proceeded with as weather permits. Plants must not be left about with their roots exposed. Those left over at the end of the day should be carefully heeled in until time permits them to be placed in a permanent position.

PREPARATIONS FOR NEXT SEASON'S TOBACCO CROP.

The tobacco crops of the past season were good where the planting-out was done early—at the beginning of November. The spring rains gave the plants a good start, while the ensuing early harvest in February or thereabouts afforded best conditions for curing. Planters who were unable to get their plants out till December missed the rains, and those crops were correspondingly short in weight. The constant recurrence of this experience makes it advisable to make every effort to adopt the former method. To do this the plants must be grown early, and that is the difficulty for many.

As the sowing should be made during the month of August the preparations may be commenced now. First obtain seed suitable for the purpose in view. As with other plants, there are a number of varieties—some unsuitable to one's climate and soil, others unsuitable

for the purpose in view. Some localities have made progress in this search for the most suitable variety for their conditions and purpose. New districts must plant experimentally for some time yet. This question of variety and strain of tobacco-seed is of first importance in attaining a high-quality product.

Owing to the uncertain germination of many samples of tobacco-seed it is very desirable, in order to avoid disappointment, to make tests before sowing. This may be done by counting out a hundred seeds, placing them between wet blotting-paper or flannel, and keeping them at a temperature of about 80° F. In a week or ten days germination of the sound seed will take place. Keep the sample moist as well as warm. An ounce of good seed should grow sufficient plants for 5 acres of crop.

Where hedge-trimmings are heaped and burnt the corn grows strong and of a good colour. There is an absence of weeds, and over the whole area of the burn the condition of the crop is so superior that it is readily seen even at a distance. The tobacco-grower should take advantage of this experience when preparing his seed-beds, by heaping such trimmings over the land where the tobacco-seed is to be sown and burning them. Among other effects, this operation sterilizes the surface soil, destroys weed-seeds, and leaves a fine deposit of potash and charcoal. The remains of the larger sticks are then raked off and the ground cultivated to a depth of about 3 in. or 4 in. At this operation a dressing of 2 lb. superphosphate and 1 lb. nitrate of soda per 10 square yards may be made and turned in. It is indispensable that the locality for this purpose should be generally warm, sheltered, and well drained. A plot 1 yard by 10 yards will grow sufficient plants for an acre, but to provide against accident it is advisable to make ample provision by laying down extra plots a little after the first sowing.

It is also necessary now to give some consideration to the land on which it is proposed to grow the tobacco crop, especially if it is now down in grass. To thoroughly clean the land before planting is important, as the less the leaves are interfered with after the tobacco is planted the better they will be. Quantities of large leaves of heavy body may be grown on strong land, but a leaf that will come out of the cure with a bright attractive colour and the requisite aroma can best be grown on a friable soil of medium quality.

—*W. C. Hyde, Horticulturist.*

WHEAT AND OATS THRESHINGS.

RETURNS of actual threshings up to 19th May received by the Government Statistician from threshing-mill owners showed that until then totals of 3,462,618 bushels of wheat and 2,410,932 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 31.36 bushels for wheat and 40.22 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 2,718,466 bushels threshed, averaging 30.15 bushels; oats, 1,050,351 bushels threshed, averaging 34.99 bushels. Otago—Wheat, 597,061 bushels, averaging 40.10 bushels; oats, 911,737 bushels, averaging 45.86 bushels. Southland—Wheat, 16,831 bushels, averaging 34.28 bushels; oats, 381,979 bushels, averaging 49.60 bushels per acre.

WEATHER RECORDS : MAY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE month of May was remarkable for the changeability of the weather. Barometric pressure had the high range of over $1\frac{3}{4}$ in. in the South, and great fluctuations occurred over the whole Dominion.

There were three anticyclonic periods, culminating on the 7th, 17th, and 31st; but between these areas of high pressure were several disturbances associated with stormy conditions. An extensive westerly depression ruled over the Dominion between the 2nd and 6th. The gradient was more severe in the North than in the South, and gales, with heavy rain, were reported, especially in and north of Cook Strait. A sudden and steep fall in the barometer on the 9th accounted for boisterous conditions and a deluge on the West Coast; pressure then continued low and the weather unsettled for a week.

An ex-tropical disturbance made its appearance to the north of New Zealand on the 17th, and, travelling slowly south, the centre apparently passed about Cook Strait on the 23rd. This, united with an Antarctic "low," resulted in nearly a fortnight of bad weather.

Rainfall was much above the average in almost all parts of the Dominion, but, considering the turbulence of the atmosphere, and partly in consequence, temperatures were comparatively mild. There were a few sharp frosts, but a good autumn growth of grass was reported.

RAINFALL FOR MAY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitiaa	8.74	18	1.80	5.06
Russell	10.56	21	2.42	3.53
Whangarei	11.51	19	3.88	6.59
Auckland	13.70	22	3.40	4.50
Hamilton	10.69	24	1.55	4.41
Kawhia	10.14	22	1.86	4.77
New Plymouth	10.13	24	2.50	6.15
Riversdale, Inglewood	19.71	25	2.86	9.82
Whangamomona	14.44	21	3.00	6.59
Tairua, Thames	12.62	17	4.20	6.11
Tauranga	8.98	19	1.20	5.16
Maraehako Station, Opotiki	4.86	18	0.78	4.82
Gisborne	4.76	13	1.54	5.67
Taupo	8.33	16	1.66	3.60
Napier	3.18	14	1.26	3.74
Maraekakaho Station, Hastings	4.48	15	1.62	3.52
Taihape	6.08	24	1.44	3.84
Masterton	6.28	22	1.13	4.03
Patea	6.44	22	1.15	3.91
Wanganui	6.42	18	1.25	3.40
Foxton	5.09	15	0.70	2.32
Wellington	4.77	20	1.08	4.76
<i>South Island.</i>				
Westport	7.34	21	1.51	6.58
Greymouth	11.78	20	2.15	8.39
Hokitika	15.05	21	2.96	9.71
Ross	16.27	20	2.58	9.73
Arthur's Pass	34.31	15	5.50	10.9

RAINFALL FOR MAY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches.
Okuru, Westland	13·14	16	1·85	11·60
Collingwood	15·85	26	2·08	10·18
Nelson	5·38	18	1·23	3·08
Spring Creek, Blenheim..	5·59	14	1·45	2·49
Tophouse	10·96	17	2·21	5·46
Hammer Springs	5·44	18	0·57	4·47
Highfield, Waiau	3·02	16	0·54	2·76
Gore Bay	1·63	8	0·43	3·43
Christchurch	3·14	20	1·13	2·65
Timaru	3·18	15	1·01	1·41
Lambrook Station, Fairlie ..	4·18	8	1·10	1·28
Benmore Station, Clearburn ..	4·30	15	1·10	1·75
Oamaru	4·19	13	1·53	1·61
Queenstown	3·18	11	1·13	2·71
Clyde	3·12	11	1·06	0·97
Dunedin	5·30	24	1·24	3·23
Wendon	2·99	13	0·77	2·31
Gore	3·73	23	0·70	2·71
Invercargill	5·56	26	0·68	4·46
Puysegur Point	8·18	25	1·18	6·81

—D. C. Bates, Director.

BOOKS RECEIVED.

"MANUAL OF DAIRY SCIENCE," by A. H. R. Amess (Director, Stratford Technical High School) and H. C. Johnson (Agricultural Science Master, Stratford Technical High School). New Zealand Practical Handbooks Series, Whitcombe and Tombs, Wellington, &c., 4s. 6d.

"FARM MEASUREMENTS: A PRACTICAL TREATMENT OF PROBLEMS IN MENSURATION," by A. G. Ruston (Lecturer in Agricultural Economics, University of Leeds) and C. V. Dawe (Assistant Lecturer). University Tutorial Press, London, 2s. 6d.

"FARM CALCULATIONS AND ACCOUNTS," by A. G. Ruston and C. V. Dawe. University Tutorial Press, London, 3s. 6d.

EGGS AND EGG-PULP IN COLD STORAGE.

A RETURN issued by the Government Statistician shows the following stocks in the Dominion as at 31st March, 1926—corresponding figures for the same date in 1925 being added in parentheses: Eggs in shell, 34,962 dozen (59,698 dozen); egg-pulp, 912,476 lb. (584,601 lb.); frozen whites, 556 lb. (1,773 lb.); frozen yolks, nil (nil).

FORTHCOMING WINTER SHOWS.

Wanganui A. and P. Association: Wanganui, 24th to 26th June.

Rotorua A. and P. Association: Rotorua, 30th June.

South Taranaki Winter Show Company: Hawera, 30th June to 7th July.

Poverty Bay A. and P. Association: Gisborne, 1st and 2nd July.

Wellington Show Association: Wellington, 10th to 24th July.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR INTERNAL PARASITES IN LAMBS.

“LAMBS,” Taumarunui :—

Do you recommend either of the following remedies for lung-worm in lambs : (1) $\frac{1}{8}$ oz. asafœtida, $\frac{1}{8}$ oz. turpentine, and $\frac{3}{8}$ oz. linseed-oil, given in half a gill of milk two days consecutively on an empty stomach ; (2) inject into windpipe with hypodermic syringe 10 minims carbolic oil, 15 minims chloroform, and 30 minims turpentine ? If not, I should be glad to have your advice for both prevention and cure.

The Live-stock Division :—

We do not recommend the intra-tracheal injection of drugs for the prevention or cure of lung-worm in lambs. The prescription of asafœtida, turpentine, and linseed-oil would probably not have very much effect on worms living in the lungs, but it might benefit the lamb on account of its action on the stomach-worm, which is usually coexistent with the parasite in the lung, and which is known to cause the greater amount of trouble. Prevention of this parasitic infestation is best achieved by keeping the lambs on dry and well-drained land on which water does not lie, and where there are no swamps or stagnant pools. A most important step in the management of this affection lies in allowing the lambs a daily ration of good easily digested food, such as crushed oats, chaff, or good hay, for without keeping up the strength of the animal by nutritious food medicines are of little use. Medicinal treatment for the alleviation of the attacks on the stomach by the stomach-worm, as advised by this Division, is the administration of a drench of lysol in milk as follows : For lambs over six months old, $\frac{1}{2}$ teaspoonful lysol ; for hoggets, $\frac{3}{4}$ teaspoonful ; for two-tooths, 1 teaspoonful—given in one-third pint of milk daily for four days. Then allow a rest of eight days, and repeat the dose if necessary. Great care must be exercised in order that none of the drench shall get into the windpipe ; and for that purpose the nose of the lamb should not be forced up into a vertical position with the object of hurrying on the process. An alternative drench is made by dissolving 2 oz. bluestone in 1 gallon water, the dose for lambs being two medium tablespoonfuls, and for hoggets four medium tablespoonfuls—to be given after fasting overnight.

RESTORATION OF GRASSLAND REVERTING TO FERN.

H. J., Te Awamutu :—

Three years ago I burnt and disked a piece of fair to medium ridge covered with fern and light manuka, and sowed it down with a mixture of English grasses and danthonia, but since then have done nothing further to it. There is still a fair amount of cocksfoot, dogstail, &c., but it is stunted, and the fern is gradually taking possession again. I thought of top-dressing it with super and Nauru phosphate, and mixing in the manure some brown-top, paspalum, and subterranean clover, and tripoding it well. What quantity of seed would you advise per acre ?

The Fields Division :—

As your land is light, medium-class country, the application of superphosphate now at 2 cwt. to 3 cwt. per acre would probably be most suitable. When such country is commencing to deteriorate it is better to use a liberal dressing at the commencement. If it is safe to use the mover over it there should be no difficulty in bringing this paddock back to profit. Mow the paddock during September, just when the new fronds are appearing, and rake into windrows and burn. Then give the paddock a thorough harrowing with good stiff tripod harrows.

This will tear out bracken and piripiri and generally open up the old pasture. The conditions would then be right for sowing a light mixture of grasses and clovers. This should be mixed with, say, 1 cwt. super, and should include the following per acre: Paspalum, 8 lb.; brown-top, 1 lb.; subterranean clover, $\frac{1}{2}$ lb.; white clover, 1 lb.; cow-grass, 1 lb. After the first stocking the tripod should again be used, and if periodically run over the paddock when the fern commences to make growth it will eventually be controlled. The feeding-out of crops or hay on the field will greatly assist in crushing the fern, and the resulting treading by stock and scattering of dung will do much to encourage a close sward.

NITROGENOUS TOP-DRESSING FOR PASTURE.

"FERTILIZER," Rangiora :—

I have noticed that where cattle, &c., urinate on the grass the growth soon becomes very dark green and luxuriant, and it is these patches that are fed down first. I propose to top-dress a paddock with super, and would be glad to know what artificial fertilizer I can add to the super to produce this dark-green rapid growth, and whether you think it a good proposition.

The Fields Division :—

The dark colour which appears in grass on which stock have urinated is no doubt due to the nitrogen compounds present. The best artificial substitute would be nitrate of soda or sulphate of ammonia. On silty or light soils the former may be tried, and on heavy clay lands the ammonia compound should be used. These dressings should not be applied with the super, except perhaps in small quantity, but should be made as a top-dressing soon after the grass freshens in the spring, at the rate of about 1 cwt. per acre. Experimental evidence to date in Canterbury is in favour of 2 cwt. of super applied during the winter months.

SHEEP WITH OPHTHALMIA.

O. W. GREEN, Marton :—

Going through the hoggets the other day I noticed some with running eyes. On examination I found the eyelid inflamed and the ball of the eye turning a whitish colour; one or two of the animals were quite blind. They are in good condition otherwise. Can you please advise me on the matter?

The Live-stock Division :—

The condition affecting the eyes of your sheep is known as ophthalmia. It appears annually in various districts, but rarely assumes epidemic form. Treatment consists in separating all affected animals from the rest of the flock, placing them in a safe paddock, bathing the eyes with boracic acid in water, and changing the feed.

KEROSENE-LAMPS FOR HEATING GLASSHOUSES.

"Beginner," Wanganui :—

Regarding the heating of glasshouses with kerosene-lamps, would the smoke or fumes be harmful to plants, and would it be advisable to use a shaded light or a bright one? What would be a safe temperature to maintain on a frosty night for tomatoes?

The Horticulture Division :—

Well-trimmed kerosene-lamps would be handy in a glasshouse in a cold snap, and whether they were shaded or not would probably make little difference. What would be a safe temperature would depend on how the plants had been grown; strong tomato-plants in fairly dry condition should not suffer if kept above 40°-45° F. While useful in an emergency, it is doubtful whether these lamps would be a satisfactory and economical method for general heating purposes.